SEPTEMBER/OCTOBER 1981 $3.00

Classroom Computer News

TEACHING THE TEACHERS
POET—A PROGRAM FOR WORD PEOPLE
COMPUTERS IN THE SCIENCE LAB

ATARI® Personal Computers: do as much for students

With ATARI computers in your school, teachers and students share the benefits.

Teachers, you'll have more time for teaching, because you'll be relieved of unproductive routine. And you can be more creative in the content and methods of your courses because of the availability of varied program information and the multi-function capabilities of an ATARI computer.

Students will learn more because they can have more fun learning. And the simplicity of operation of ATARI computers allows them to proceed independently without constant teacher supervision and involvement.

Dollar for dollar, ATARI computers can do more for teachers, students and administrators.

When you consider that a good microscope or even a simple shop lathe can cost more than an ATARI Personal Computer you begin to realize what a bargain it is. Even if a single ATARI computer is utilized only as an example to students of the importance of computer technology it will be worth its small cost. But consider the potential when students learn what a computer is by using it for all this: laboratory simulator, mathematics calculator, problem solvers, thinking laboratory, word processing, statistical analysis, information storage and retrieval, artistic canvas, music instrument, and, yes, playground, too.

And ATARI computers provide a bonus for school administrators, too. In addition to education functions they can be utilized for word processing, classroom management systems, record keeping, career counseling, etc.

There is a lot more to an ATARI computer than meets the eye.

Most computers can do so much you may overlook a detailed evaluation of what they do and how well they do it. If you want to find out if the computer you're considering will give you *all* the capabilities and functions you are paying for, check it out against an ATARI Personal Computer.


TO IDENTIFY THE 50
STATES AND CAPITALS
uniquely designed to
as for schools.
• A variety of computer languages including a modern version of PILOT: The easy-to-learn, inter-active language that accelerates computer literacy. "Turtle" graphics make it easy to create designs and pictures
• Upper and lower case keyboard and display with inverse video feature
• Easy to use screen editing functions
• Built-in, 4-channel, sound capabilities
• Built-in animation capabilities
• Built-in graphics capabilities
• Full-color graphics display
• 128 color variations
• Connects to standard color or black and white TV or video monitor
• Highly developed software for full utilization of the computer's capabilities
• Foolproof hook-up
• Plug-in cartridges
• Programmable sound effects
• Music with up to four voices
• Taped audio under program control
• Safety features specifically designed to suit classroom requirements
• Comprehensive software availability
• Designed for expansion and flexibility
To arrange for a demonstration of an ATARI computer and a comprehensive rundown of its potential for students, teachers and administrators, write to:
ATARI Inc., Computer Division, 1196 Borregas Avenue, Dept. E-11, Sunnyvale, Ca. 94086.
Or call: 800-538-8547 (800-672-1404 in California).
ATARI®
Computers for people.™
© 1981 Atari, Inc.
A Warner Communications Company

TSC, A Houghton Mifflin Company, introduces Dolphin™ computer-based instruction.

Dolphin™

For the performance of a lifetime.

I would like to learn more about Dolphin™ computer-based instruction.

- ☐ Please send me more information.
- ☐ I am interested in seeing field validation results.
- ☐ I would like to talk to a TSC representative.
- ☐ Please send me your 1982 Career Guidance Catalog.

Name________________________

Position________________________

School/District________________________

Address____________ City________ State_____ ZIP_____

Phone (   )________________________

Mail to:
TSC
A Houghton Mifflin Company
Dept. 42
Box 683
Hanover, NH 03755

Finally *quality,* fully validated curricula of a major publisher are available on a powerful, in-the-classroom computer system. **Dolphin**™ computer-based instruction joins a century of Houghton Mifflin curriculum expertise with breakthrough, state-of-the-art technology to create one of the strongest skills mastery packages ever offered to the serious educator.

The **Dolphin**™ curricula—*Reading (3-8), Language Arts (3-8), Math Computation (1-8),* and tutorial *Math Problem Solving (5-8)*—are based largely on proven Houghton Mifflin paper-and-pencil materials backed by years of teacher and student use. Once adapted for the computer, they have been proven *to significantly increase skills performance—in some cases by three times!**

The **Dolphin**™ curricula come to you on a full-fledged computer system that starts out where so-called "personal computers" leave off. Here's a computer developed with the curricula in mind—instead of the other way around. While small enough to sit on a table top, the **Dolphin**™ will drive up to eight computer terminals simultaneously! And you can say goodbye to cumbersome and delicate floppy disks forever.

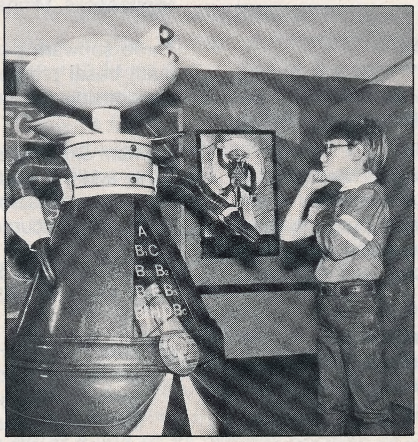
Add a comprehensive management system that documents student progress and virtually eliminates record keeping, and you've got the **Dolphin**™—the smart choice in computer-based instruction. (The **Dolphin**™ even offers *The Guidance Information System,* the world's favorite computerized guidance resource!).

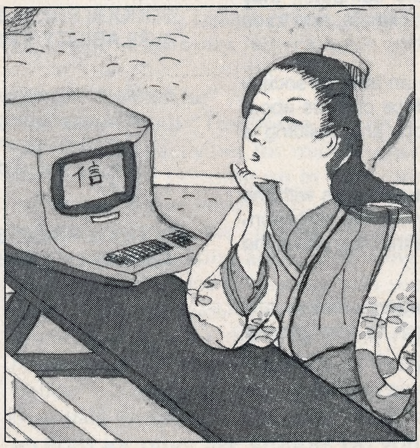
*For field validation results and additional information, just clip and mail the coupon.

September/October 1981 Volume 2, Number 1

Classroom Computer News


12


27


18

Cover: Photograph by Alfred Fisher

McGRAW-HILL:
COUNT ON US FOR MICROCOMPUTER SOFTWARE

Now—the School Division of McGraw-Hill combines expertise in education and technology to provide the quality educational software that schools have been waiting for. Our fall 1981 software packages—developed by teachers and field tested in classrooms—offer three key areas of computer assisted instruction.

SIMULATIONS (Grades 4 and above)

THE SEARCH SERIES
by Tom Snyder © 1982
Computer Learning Connection
Cambridge, Massachusetts

Give your students the exciting opportunity to search for oil, explore new continents, dig for an ancient civilization or develop new energy sources for the nation.

An entire classroom of social studies or science students can work toward search goals on one microcomputer. Each program of the Search Series can be integrated with any basal program (and with the scope and sequence of your own curriculum). And each is complete with software, student workbooks, and teacher's manual.

- *Geology Search* sends student off exploring for oil. As the computer "performs" geological tests, students learn about rocks, fossils, and underground structures in order to make decisions on drilling.
- *Geography Search* puts groups of students on ancient ships searching for the New World. Through the computer, they navigate using the sun, stars, ocean depth, climate, and trade winds.
- *Community Search* sets students down in an ancient society forced to leave its ancestral home. They face choices about migration, occupations, trades, aggression, and building a palace.
- *Archeology Search* charges student research teams with the task of organizing the excavation of a newly discovered historical site. Students collect data and formulate theories about the origins of the people who once lived there.
- *Energy Search* has students manage an energy factory and recreate the exciting steps taken in search of new energy sources.

PRICE: $180 per program.
AVAILABILITY: TRS-80, Apple II

COMPUTER LITERACY (Grades 4 to 6)

INTRODUCTION TO MICROCOMPUTERS
by John Haugo © 1982
Edusystems, Inc.
Minneapolis, Minnesota

Computer literacy—a skill that stretches from your classroom into your students' world of tomorrow. It's easy to teach and fun to learn on our new six-program software package INTRODUCTION TO MICROCOMPUTERS. Students use games like "Rocket Numbers," "Keyball," and "Computration" to learn the parts of the computer, simple computer terminology and keyboarding skills. The package includes teacher's notes and reproducible student activity sheets.

SCHOOL PRICE: $47.49
AVAILABILITY: TRS-80, Apple II, PET

DRILL AND PRACTICE (Grades 4 to 6)

MATH DRILL AND PRACTICE SERIES
by John Haugo © 1982
Edusystems, Inc.
Minneapolis, Minnesota

Three software packages to complement and supplement your math basal program. All include teacher's resource guide with reproducible student activity sheets.

- *Math Skill Games* provides drill and practice at three skill levels in addition, subtraction, multiplication and division. The 12 programs use both words and graphics to increase speed and develop accuracy.

SCHOOL PRICE: $58.95
AVAILABILITY: TRS-80, Apple II, PET

- *Math Word Games.* This six program package builds skills in solving math word problems. The program illustrates the problem to be solved—the student determines the correct operation to be used, and solves the problem. Reading level is controlled at or below the level of math content.

SCHOOL PRICE: $38.25
AVAILABILITY: TRS-80, Apple II, PET

- *Math Regrouping Games.* Uses graphics to promote success with regrouping/renaming skills in addition and subtraction. The 10-program package provides students with drill and practice and helps diagnose where students are experiencing difficulty.

SCHOOL PRICE: $58.95
AVAILABILITY: TRS-80, Apple II, PET

Want to know more?

Call our Microcomputer Hot Line **(800-223-4180)** to check for a software demonstration in your area or to ask for more information.

Ready to order? Send your purchase order to:
TECHNOLOGY MARKETING MANAGER
School Division
McGraw-Hill Book Company
1221 Avenue of the Americas
New York, NY 10020

Classroom Computer News

Editor
Lloyd R. Prentice

Associate Editor
Laurie Beckelman

Art Director
Mary Rothenbuehler

Features Editor
Phyllis Caputo

Contributing Editor
Jeff Nilson

Regional Contributors
William D. Hedges (Florida)
Tom Lee (Michigan)
Harry B. Miller (Louisiana)
Barbara Sadowski (Texas)
Jack Turner (Oregon)
William J. Wagner (California)
Harry Wolford (Ohio)
Karl Zinn (Michigan)

Production Assistant
Ed Hogan

Publisher
Lloyd R. Prentice

Advertising Representatives
Eastern Region:
Robert D'Ambrosio (212/354-0001)
Midwest Region:
Jerry Driscoll (312/885-7717)
Western Region:
John Bourke (415/332-9070)

Advertising Coordinator
Jennifer Fischer

Circulation Manager
Katharine G. Cipolla

Business Manager
Douglas Wales

Office Manager
Laura Koller

Staff Assistants
Trudy Landry, Lisa Papandria, Joanne Pinzone

Classroom Computer News is published by: Intentional Educations, 51 Spring St., Watertown, MA 02172.

Subscriptions: 1 year $12.00; 2 years $21.00; 3 years $30.00. Please send all subscription correspondence to: *Classroom Computer News*, P.O. Box 266, Cambridge, MA 02138; 617/923-8595.

Forum

Ink and Ice Cream

I'll never forget the oddly pleasant comingling of odors—ink and ice cream. We were racing a postal deadline—fingers stiff from folding and smarting from paper cuts. The occasional bemused glances from the young scoopers behind the freezers were not unsympathetic, but a corner table in a Harvard Square Baskin-Robbins was indeed an odd place to be folding and stuffing the premier announcement of an exciting new computing publication. It's just that the ice cream parlor offered the most convenient horizontal surface along the bee-line between the printer and the post office, and we had not a minute to spare in getting our missives into the impatient mail.

It was just one year ago that Laurie Beckelman, Phyllis Caputo and I coopted that table at Baskin-Robbins. Since then six deadlines have come and gone and now we're racing a seventh. But somehow this seventh deadline is more like a first—as frantic and urgent and exciting as ever. It's the first issue of the second volume, but much more. For this deadline we're completely recreating *Classroom Computer News*—working on a new format, new production procedures and new columns and features. Some of the results of our efforts you'll see in this issue and some will show up in issues to come, but we're trying to open up more space to give you more information in more depth and more visual variety as we strive to keep you ahead of the computer revolution in the schools. Our newsletter format of Volume 1 served well and you responded warmly and enthusiastically to *CCN*'s "accessibility, friendliness and readability." But you have asked for more of everything—more applications, programs, tutorials, profiles, industry roundups and think pieces—and we want to do more of everything in our power to comply.

So with this issue we begin the evolutionary process of transforming *Classroom Computer News* from a newsletter to a full-fledged magazine. You'll note a new paper stock, a new cover and a brand new section called "Treehouse" for middleschool youngsters. Things are bubbling here in greater Boston and all because of your enthusiasm and support over the past year.

As I review the past year, I feel a tremendous debt of gratitude to the staff, regional contributors, subscribers, advertisers and ad reps, as well as to our publishers, Intentional Educations, all of whom have helped bring *Classroom Computer News* to its present position of leadership. As I look forward to this next year, I'm impatient to get on with the hundreds of new ideas that have come out of our year-long collaboration. With your continued support, I want to make *Classroom Computer News* bigger and better than ever.

About "Treehouse"

A word about "Treehouse." "Treehouse," an editorial section devoted to computer-related activities for middleschool youngsters, is the first of many ideas that you'll see popping up in *Classroom Computer News* in the near future. A tree in computer parlance is a way of representing a diversity of data in computer memory. "Treehouse" is a way of helping you stimulate your youngsters with new ways of thinking about and using information. We encourage you to use "Treehouse" in your classes as you see fit—you may adapt it, extract from it, copy it for your own classroom use or order quantity reprints from us at nominal prices. We only ask that in any use you credit *Classroom Computer News*. But more—we ask for your feedback. Do you like or dislike the concept of "Treehouse?" Would you like us to devote more or less space to student-oriented material? Would you like to see a different format, different information, similar sections for other age groups? Do you have ideas you'd like to contribute? In this and every other section of *Classroom Computer News*, we welcome your ideas.

Lloyd R. Prentice

SYBEX HAS THE BASIC IDEA

Let the chips fall where they may. These two books on BASIC assure comprehension and comptence.

INSIDE BASIC GAMES

by *Richard Mateosian* teaches interactive game design and BASIC programming through thorough analysis of eight different kinds of computer games. Programs are presented in Microsoft BASIC with versions for PET/CBM, TRS-80 and APPLE II.

350 pp., 120 illustr., Ref. B245, **$14.95**

FIFTY BASIC EXERCISES

by *J.P. Lamoitier* provides the surest way of learning BASIC —actual practice. Graduated exercises, each containing a detailed explanation, flowchart and sample run, develop skill and competence rapidly. Applications include mathematics, business, operations research, statistics and more.

256 pp., 194 illustr., Ref. B250, $1295

COMING SOON

BASIC PROGRAMS FOR SCIENTISTS AND ENGINEERS

by Alan R. Miller

PLEASE SEND ME ☐**INSIDE BASIC GAMES**
☐**FIFTY BASIC EXERCISES**

MAIL TO:
SYBEX DEPT. ***CCN1***
2344 SIXTH STREET
BERKELEY, CA 94710
PHONE ORDERS:
INSIDE CA 415/848-8233
TOLL FREE OUTSIDE CA 800-227-2346

NAME ______________ ☐ **SEND ME YOUR FREE CATALOG**
ADDRESS ______________
CITY ______________ **STATE** ______ **ZIP** ______
ADD ☐**$1.50/book UPS or** ☐**75¢/book 4th class mail or** ☐**$8/book overseas airmail**
(CA add tax) Total Amt. Enclosed ______ **OR CHARGE MY** ☐**VISA** ☐**MC** ☐**AM EX.**
CARD NO. ______________ **EXP. DATE** ______________
SIGNATURE ______________

On Line

Fall Education Programs Planned

The Creative Computing Education Center has announced a comprehensive fall education program. Starting September 20 and running through November 20, the Computer Education Center will offer a full schedule of weekday, evening and adult education programs as well as a Saturday morning program for youngsters.

Evening adult education courses will include a four-session, eight-hour course in Computer Literacy. In-depth, 20-hour courses in beginning, intermediate and advanced BASIC programming are also offered in the evening for adults.

Three Computer Blitz weekends will be given by Russ Walter this fall. These intensive workshop seminars covers virtually every aspect of microcomputer selection and use in two information-packed, ten-hour days.

Another weekend offering is Saturday morning "Computers for Kids." Following the successful format of the Computer Camp, in which over 100 students participated this past summer, the Saturday sessions will teach BASIC programming concepts to young people ages 10 to 17. From 9:30 a.m. to 12:30 p.m. each Saturday for eight weeks, youngsters will learn to write and run their own programs and will gain an overview of the microcomputer world through slides, videotapes and films.

For further information contact Barbara C. Garris, Creative Computing Education Center, 39 East Hanover Avenue, Morris Plains, NJ 07950; 201/540-0445,ext. 45.

Courtesy of Children's Television Workshop

Educational computer games originally developed for the Computer Gallery at Sesame Place will soon be available to the general public.

Apple and CTW Software Effort

Apple Computer Inc. and the Children's Television Workshop, creators of *Sesame Street*, have combined talents to design, develop and distribute 20 software programs for use on Apple personal computers.

The programs are an outgrowth of 50 educational games developed by the Children's Television Workshop (CTW), and were tested over the past year at the Sesame Place Computer Gallery, a component of the Sesame Place play park in Langhorne, Pennsylvania.

The Children's Computer Workshop, a division of CTW, decided to adapt the 50 games used at Sesame Place into 20 marketable programs to allow public access to these informal educational programs. Apple will publish the programs, then distribute them through its more than 1,000 U.S. computer retail dealers under the Special Delivery Software label.

The games use sound, color and animation to acquaint three-to-13-year-olds with computers. Program concepts include tests of problem solving and creative and artistic challenges.

For further information, contact: Apple Computer, Inc., 10260 Bandley Dr., Cupertino, CA 95014.

Southwestern Enters Software Market

Southwestern Publishing Company, a subsidiary of Scott, Foresman and one of the leading business education and business administration publishers in the country, has entered into agreements with both Radio Shack and Apple Computer Inc. to produce business education software. This is the Cincinnati-based publishing house's first entry into the educational computing market. Southwestern will develop software for the TRS-80 Model I and Model III computers and for the Apple.

Noteworthy Publications

- *Microcomputers in Education Conference Proceedings:* A 340-page book including over 30 articles by educational computing experts who presented papers at a January 1981 conference hosted by The College of Education at Arizona State University. The articles include: "Using Computers with Blind and Deaf Children"; "Managing Instruction with a Micro." The proceedings are available for $10.00 per copy. Send checks payable to Arizona State University to: Dr. Gary Bitter, Arizona State University, Payne B203, Tempe, AZ 85287.

- *Small Computers in Libraries* is a new monthly publication of The Graduate Library School of The University of Arizona. Its aim is two-fold: to act as a clearinghouse for information on microcomputers in libraries and to offer computer novices guidance through program and book reviews, tutorials and glossaries. Subscriptions are $20/year from SCIL, Graduate Library School, University of Arizona, 1515 E. First St., Tucson, AZ 85719.

- *1981-82 Audio-Visual Equipment Directory:* The most recent edition of the National Audio-Visual Association's annual directory includes an enlarged section on microcomputers for A-V applications and a new section on computer-generated graphics equipment. The directory retails for $21 per copy if payment is sent with order, or $24 if billed. Send orders to: NAVA, 3150 Spring St., Fairfax, VA 22031.

When the Teachers Ask...

Heading Off Hang-Ups

by Beth Lowd

From the questions teachers ask me, I have compiled a list of essential understandings that the naive computer-user seems to need in order to use a computer with confidence. To the experienced user, some of these concepts will seem so obvious as to need no explanation—and this is the danger. Until these simple mysteries are solved for each new user, the computer retains those "magical" qualities that inspire awe and fear rather than creativity. The computer cannot become a tool until the user understands that it doesn't have a mind of its own!

I will not attempt to put the list in order of importance (or in any other order) since every new user's needs are slightly different.

1. Program Control vs. User Control: To give a fearful teacher a first successful experience with a computer, we often show a simple program and ask the teacher to try using it. In my experience, the teacher often thinks the computer itself is responding to him/her, not realizing that a program is in control (or even what a program *is*). The character of this first-experienced program becomes a standard for all future programs; the new user cannot understand why, in a later experience, the computer acts differently.

To avoid this, I sometimes begin by having the user control the computer. Keyboard exploration, the use of PRINT statements and finally, variations on a two-line program, seem to do the trick. As the user gains control, he/she soon sees how inconvenient it is to retype direct commands to produce a slight change. Once line numbers are introduced, he/she sees that a program is just a list of instructions worded in the computer's rather limited vocabulary. Using the classic:

```
10 PRINT "HELLO,"
20 GO TO 10
```

also gives an opportunity to introduce the idea of stopping a program. The fact that one must stop the current program in order to do something new is crucial. Repeated practice in stopping and starting programs must be part of a new user's experience.

2. Memory: Restarting a program brings up the concept of memory. Users want to know *how* the computer remembers and also *how much* it can remember. (Most microcomputers can hold only one program at a time, so magnetic storage of programs on tape or disk must also be explained here.) I keep the explanations simple, but invariably I find the new user wants to know more than that the code for a program is stored "electronically." This brings us to the concepts of code and language.

3. Code and Language: For a long time, I tried to avoid getting into the idea of binary code, but I find that many (not all) users continue to see the computer as "magical" until they grasp that letters and numbers are represented by unique, eight-digit, on-off codes. This explanation also leads users to ask about the relationship between the binary codes and a computer language. Understanding that the computer compares sequences of binary codes with sequences stored in its memory seems to help the new user understand why a computer's vocabulary is so limited and why it cannot infer that RRUN is merely RUN mistyped.

> ***To avoid confining the new computer-user's dreams, we must demonstrate the range of possible functions of this new tool.***

4. Strange Keys: Before using the computer, a new user is likely to feel somewhat comforted that the keyboard is "just like a typewriter." Because the user is familiar with 90 percent of the keys, he/she can easily fail to ask about some of the unfamiliar ones. RETURN (or ENTER) is one that trainers always explain, and users must learn the STOP and CTRL key in order to halt a program's operation. The keys used for editing, reverse field and cursor control, however, can be more complex to use, so many of us tend to think that introducing them later, after the user is more comfortable, is best. My experience, however, has been that these keys are another potential source of mystery. If hit unintentionally, they make the computer do something very unexpected, which makes the new user feel he/she has lost control. In this situation, to quit, feeling stupid, and let the computer "win" is pretty normal adult human behavior (kids just hit some more keys to see what will happen). Thus, I have begun demonstrating the function of these keys in my introduction for teachers. I give them a written reference sheet so that they needn't feel they have to remember how each key works.

5. Variety of Examples of Use: As I mentioned earlier, new users tend to see the computer as a single-purpose machine. To broaden their view, they need to experience a variety of possible uses: to see the computer as calculator, word processor, monitor and data gatherer; to use it for simulations, graphics activities, logic games, VisiCalc, data base maintenance, as well as for drill and practice. We must depend on creative teachers to integrate the computer as a tool in their curriculum—no one else can do it for them. So right from the start, to avoid confining their dreams, they need some idea of the possible functions of this new tool.

I perceive two other crucial needs that I will just mention: time to develop familiarity with the machine to be used and a good back-up reference manual. Time means several hours with a reference person, plus several more hours working independently. The reference manual must be simple, because after several days away from the computer, the new user is likely to forget the function of even the RETURN key. □

Beth Lowd is an instructional computing specialist with the Lexington Public Schools, Lexington, Massachusetts.

Math Education: A Bibliography

by Wilbur Parrott

This is the first in a series of CCN bibliographies on the use of computers in selected curriculum areas. Listed articles cover preschool math through calculus and model building and are practical in nature. Classical articles in the field, such as Patrick Suppes's 1966 article for Scientific American, *are also cited. Articles that include programs and/or bibliographies are included as often as possible. Articles cited appear in commonly available publications.*

Bell, Frederick H. "Can Computers Really Improve School Mathematics?" *Mathematics Teacher,* May 1978, 71(5):428-433.
A general review of the place of computers in school math, including history of developments, uses of computers for math and the effects of computers on math education. Excellent introduction to the subject.

Carlson, Ronald. "Complements & Supplements." *Creative Computing,* September 1980, 6(9):140-142.
Program and short explanation given for solving algebra problems concerning complements and supplements. For students at different levels.

Cook, Willis H. "Math Teacher." *Microcomputing,* June 1980, Number 42:134-136.
Program for practicing long division. This is a step-by-step approach that solves the problem by requesting one digit at a time. The program repeats a problem if it detects an error in calculation. (Copy of program included.)

Dennis, J. Richard. "Computer Classification of Triangles and Quadrilaterals—A Challenging Application." *Mathematics Teacher,* May 1978, 71(5):452-458.
Flow chart solution to the problem of how to build a program that identifies six types of triangles and combinations of these. Also includes a flowchart for solving four types of quadrilaterals and their properties. Intended for students in latter part of year's course in plane geometry.

Dunn, Samuel L. and Lawrence W. Wright. "Models of the U.S. Economy." *Mathematics Teacher,* February 1977, 70(2):102-110.
Suggests ways that students of economics or mathematics can build models to study the U.S. economy. The article describes the models and provides a program that tests their assumptions. Introduction to mathematical models included. For secondary school students. Bibliography included.

Gawronski, Jane Donnelly, John Hendrickson and Joan Fehlen. "Computer Assisted Instruction in the Elementary School." *School Science and Math,* February 1977, 76(1):107-109.
Description of basic modes of computer-assisted instruction with elementary arithmetic as example material. Presents a multi-media approach for teaching the use of the terminal.

Hastings, Donald. "Preschool Math." *80 Microcomputing,* April 1980, Number 4:77-78.
Program for preschool math (addition only) that enables a child to begin working with a computer and practicing math facts. Program provides problems of varying difficulty, based on the child's responses. Copy of the program printout included.

Hay, Louise. "Using the Computer to Help Prove Theorems." *Mathematics Teacher,* February 1981, 74(2): 132-138.
The computer is usually associated with quick and accurate calculations. But it is also "possible to use the computer as a large and efficient 'scratch pad' to test conjectures and suggest methods of attack" in proving mathematical theorems. The computer is used to generate possible counter-examples. Explanations, illustrations and programs included.

Hutcheson, James W. "Computer-Assisted Instruction Is Not Always Drill." *Mathematics Teacher,* December 1980, 73(9):689-691, 715.
A microcomputer is used in a statistics class to help students understand random samples. The author reports a shift in emphasis from the arithmetic of statistics to statistical thinking. Includes a copy of the program.

Joffe, Allan S. "Equations." *80 Microcomputing,* March 1980, Number 3: 84-87.
Offers simple techniques and short programs for solving algebraic equations with known real roots.

Joffe, Allan S. "Oh No! Calculus." *80 Microcomputing,* January 1980, Number 1:114-116.
The program is intended to introduce the concept of integration. The example program that is printed and explained relates to a waveform. Emphasis on graphics.

Johnson, David C., Ronald E. Anderson, Thomas P. Hansen and Daniel L. Klassen. "Computer Literacy—What Is It?" *Mathematics Teacher,* February 1980, 73(2):91-96.
The mathematics education profession advocates that computer literacy be provided for all students. This article tries to make this general statement more specific by providing an extensive list of objectives for computer literacy.

Johnsonbaugh, Richard. "Applications of Calculators and Computers to Limits." *Mathematics Teacher,* January 1976, 69(1):60-65.
Computers are often seen as a supplementary tool that provides an easier or an alternative way for making computations. This article uses the computer "as a motivating, essential device" to explain the theoretical aspects of a limits problem.

Landry, Michael. "Algebra and the Computer." *Mathematics Teacher,* December 1980, 73(9):663-667.

Math/Science

Presents a technique for solving linear equations. The technique is taught in a mathematics program that routinely introduces computer programming in first year algebra, second year algebra and geometry classes. The article emphasizes mathematics skills over computer programming for its own sake.

Laycock, Mary. "ADAM Comes to Nueva." *Arithmetic Teacher*, January 1980, 27(5):46-47.
ADAM is a computer with a programming language children can use with minimum instruction. The article describes games, plots and graphics that the children programmed. Emphasis on math applications.

Leonard, William A. and David L. Pagni. "A Computer Meets a Classical Problem." *Mathematics Teacher*, March 1980, 73(3):207-212.
Students solve a classical problem in number theory devised by Carl F. Gauss (1777-1855). In the program presented, students learn how computer efficiency affects the solution. Bibliography included.

Mazen, Henrietta, Abraham M. Glickman and Sherrill Mirsky. "A Symbiosis between the Computer and the Curriculum." *Mathematics Teacher*, May 1978, 71(5): 435-438.
The emphasis is on the process of teaching students to write their own programs to solve problems in geometry. Sample programs included.

McCabe, John and Marshall R. Ransom. "Trial and Error—Adams, Bettr, Best." *Mathematics Teacher*, May 1979, 72(5):348-350.
Through the use of microcomputers, students explore number patterns by a trial-and-error method. The students themselves develop the solutions.

Menis, Yosef, Mitchel Snyder and Ezra Ben-Kohav. "Improving Achievement in Algebra by Means of the Computer." *Educational Technology*, August 1980, 20(8):19-22.
Reports on a three-year experiment using computer drill exercises to improve the attitudes and achievement of tenth-grade high school pupils who were weak in mathematics.

Noddings, Nel. "Word Problems Made Painless." *Creative Computing*, September 1980, 6(9):108-113.
This outlines a four-stage computer-based curriculum for problem solving. The course is aimed at removing some of the dread and fear associated with solving word problems. Intended for Grades 3-6. Bibliography included.

Norris, Donald O. "Let's Put Computers into the Mathematics Curriculum." *Mathematics Teacher*, January 1981, 74(1):24-26.
The author proposes a drastic restructuring of the mathematics curriculum in the traditional high school. He suggests that plane geometry should be deleted as a required course and replaced by computer programming.

Orr, H. T. (Tom). "Fraction Tutor." *80 Microcomputing*, January 1980, Number 1:80-81.
Provides a program that takes a child step-by-step through the process of adding fractions. Each of the eight steps includes checks for errors, a clear and detailed explanation of the process and a copy of the program.

Peelle, Howard. "Teaching Mathematics Via APL (A Programming Language)." *Mathematics Teacher*, February 1979, 72(2):97-115.
APL is a relatively new programming language that provides many symbols for forming unambiguous and concise mathematical expressions. Examples from set theory, logic, number theory, algebra and calculus show how APL gives natural and quick access to many areas of math. Bibliography included.

Saunders, James. "What Are the Real Problems Involved in Getting Computers into the High School?" *Mathematics Teacher*, May 1978, 71(5):443-447.
Cites problems with money, teacher involvement, and computer hardware and software limitations. The author sees faculty and student interest in the computer's capabilities as a solution to many of the problems.

Statz, Joyce and Leland Miller. "The Egg Series: Using Simple Computer Models." *Mathematics Teacher*, May 1978, 71(5):459-467. A simple, easily constructible model (the egg computer made from an egg carton) is used to provide a basic understanding of the computer's organization.

Stoutemyer, David R. "Symbolic Math Using BASIC." *BYTE*, October 1980, 5(10):232-236.
Minimal BASIC, a single, one-dimensional numeric array, enough memory for 110 simple BASIC statements and integer arithmetic are all the user needs for this program that expands polynomials. Adaptation for some programmable pocket calculators is possible.

Suppes, Patrick. "The Uses of Computers in Education." *Scientific American*, July 1966, 215(6):207-220.
Patrick Suppes at Stanford University headed one of the earliest CAI projects. In this classic article, he reports on his work with elementary school children. The drill-and-practice mode was used to teach mathematics.

Zabinski, Michael P. and Benjamin Fine. "A Computer Discovery Approach for Quadratic Equations." *Mathematics Teacher*, December 1979, 72(9):690-694.
This describes a unit on the quadratic equation that uses a discovery approach to the subject matter. The students integrated the computer into the study by developing their own programs. Includes copies of the program and a bibliography.

Zukas, Walter X., L. H. Berka and Judith T. Martin. "Teaching Fourth and Fifth Graders about Computers." *Arithmetic Teacher*, October 1980, 28(2):24-27.
Outlines eight lessons in a minicourse about computers. The lessons capitalize on fourth and fifth graders' innate curiosity about secret codes and games. Math is used as the example material. □

Wilbur Parrott is coordinator of elementary libraries for the West Bridgewater Public Schools, West Bridgewater, Mass.

TEACHING THE TEACHERS

An Inservice Syllabus

by Henry F. Olds, Jr.

Our formal educational process seems deeply rooted in the notion that children and adults are very different as learners. Yet during ten years of work helping both teachers and children become better learners, I have found that they are virtually the same in all the really important ways that matter for education. Children are human beings, in fact often more characteristically human in their open curiosity about the world than many adults. And adults are human beings, often more so when free to inquire honestly than when constrained to being knowledgeable grown ups. This, of course, does not mean that some of the obvious distinctions between child learning and adult learning aren't terribly important. But I have found that more can be gained by starting with some commonalities.

Truly effective inservice helps teachers learn about learning, their own and children's. It helps teachers create classrooms that offer a multitude of opportunities for children to learn in an atmosphere that sanctions and supports their learning.

Thus, the notion that the best teacher is the expert learner has been fundamental to all my work with teachers. I have evolved a process that goes something like this:

(a) Engage teachers somehow in a process of learning about something for themselves. The less familiar the subject, the more potentially rich the experience. (One of my favorites has been learning to juggle.)

(b) Have teachers reflect on their own learning and share these reflections with peers.

(c) Have teachers observe instances of children's learning.

(d) Have teachers reflect on their observations and attempt to compare these reflections with those on their own learning.

(e) Ask teachers to begin to formulate some tentative new generalizations about learning and teaching.

Computers for Teachers

I have been working with computers lately because their recent and rather rapid proliferation in education clearly poses challenges to education and teaching. But I have discovered that the opportunities computers create for teachers to become involved in deepening their teaching practice are as great as the challenges are formidable. Coming to understand computers provides opportunities to learn that can take teachers well beyond where they are in their own professional development.

How does this happen? I know for sure that it doesn't happen the same way for every teacher. It doesn't happen when teachers are "trained" by computer enthusiasts (hi-techies). I agree with Jim Edlin, one of the more perceptive writers on microcomputers, who has pointed out: "In microcomputers lies the seed of an invention with the power to catalyze major beneficial changes in our lives; this invention doesn't stand a chance of reaching fruition until it is wrested from the hands of 'computer people.' " The best inservice programs I have seen have been developed and implemented by teachers for teachers, and this will continue to be the case for learning about computers.

Teachers will also have a hard time coming to know about computers if a traditional academic approach is taken. Courses in computer literacy teach *about* computers, which is very different from learning *how to do something* with computers.

I do strongly agree with those who argue that teachers and children should learn to program computers. But I mean programming in its most general sense of teaching the computer to do something, not programming in the commonly understood

narrow sense of writing programs in some high-level language such as BASIC. Everyone should learn in some way that makes sense for his or her needs how to teach a computer to do something. But that learning does not have to be elaborate or difficult.

We can think about teaching the computer in a wide variety of ways, ranging from the relatively simple, limited function tools with little or no special language requirements to, on the other extreme, the elaborate and complex tools and high level languages. There are also many intermediate possibilities.

Teachers ought to have a chance to explore teaching the computer in a large number of these ways so that they will gain a rich sense of what it means to do so. In my experience, when teachers teach the computer, in whatever way, they begin to explore some important dimensions of their own learning.

Learning to teach a computer not only clarifies that people are in control of making this technology into useful tools, but also begins to suggest that the tools can amplify our intelligence. We can catch a glimpse of why this technological development may be more significant for the future growth of human consciousness than any technological development that anyone alive today has experienced. The idea that computers can make all of us inventors and creators of our own intellectual tools is difficult to express and to understand, but it is the central idea for educational progress. And it is the idea that I think must be the cornerstone for any inservice program for teachers.

Learning to teach the computer to do many kinds of things and thinking about one's learning builds both an understanding of the technology and an understanding of oneself. The computer is not intelligent or dumb—it can only reflect our own intelligence or lack of it. It is an honest and patient mirror of our own mind. If teachers can begin to appreciate and learn from the reflections they see in this mirror, they may begin to know the power this technology gives to education. And, most important, they may allow students to use computers to explore their potential for learning in much the same way.

Toward Some Workable Procedures

I would like to propose some procedures for an inservice education program. The goal of the program is to bring teachers to understand the microcomputer as a tool-making technology that asks people to learn how to teach it to do something, rather than as a medium for teaching something to someone. Not all educators will be comfortable with this goal, for the notion of learning by teaching a computer might fly too strongly in the face of the traditional teaching pattern of learning by being taught.

Many teachers will find some comfort in this goal because it in no way suggests that the microcomputer can replace the teacher. In fact, accepting this goal means needing more qualified teachers. But the teacher's role may change a bit. Teaching and learning may become a much more intensely cooperative and creative venture between teacher and student.

The following inservice syllabus is presented in the form of a program, using a language that I made up for the occasion. To my knowledge this program will not run on any computer—it is intended for people, not computers. The reason for the program is that it helped me think about and sequence a set of procedures. It did for me what outlines do for others.

There are no special secrets to reading the program. The line numbers are a guide to follow, and you do so in order until told to do other-

Courtesy of Lesley College

Teachers who feel competent to analyze textbooks and related print materials can apply the same critical eye to the computer's particular abilities.

wise. GOSUB means go to the line number indicated and follow the numbers until you reach a line that says RETURN. At that point you go back to the line immediately following the one that said GOSUB. REM means that what follows on that line is a remark about the operation of the program, not an actual piece of the program proper. The rest should be self-explanatory.

Understanding the Microcomputer

10 REM *** The following procedures can be expanded or compressed depending on the time available. Two variants are suggested: a three-day, intensive workshop with two or three half-day follow-up sessions in succeeding months, or a normal 12- to 15-week course format with one three-hour class per week.
20 REM *** The examples I have provided are not the only available ones, but I have found them workable and useful. They are all available for the Apple II computer. I am sure that similar programs are available for the other widely used computers.
30 REM *** The program begins here.
40 CREATE Groups of three to five (ideal) persons at each computer: REM *** Small groups of people working together on a computer are the ideal because the people help each other learn.
50 GOSUB 100:REM *** Teaching the Computer—Phase I—*Animals* & Beyond.
55 GOSUB 200:REM *** Problem Solving With or Without the Computer
60 GOSUB 300:REM *** Teaching The Computer—Phase II—LOGO
65 GOSUB 400:REM *** Teaching the Computer—Phase III—The World of General Purpose Tools
70 GOSUB 500:REM *** Teaching the Computer—Phase IV—A Peek and a Poke at BASIC
75 GOSUB 600:REM *** The Many Faces of Computer Software
99 END
100 PRINT "TEACHING THE COMPUTER —PHASE I—ANIMALS & BEYOND"
130 USE *Animals* (Apple Computer Inc.)
135 REM *** In *Animals,* which is a very simple data program, the user teaches the program to become "intelligent" at guessing the animal a person has in mind by asking a series of questions. In the beginning the program "knows" only two animals (frog and moose) and only one question to distnguish between them (Does it live in the water?). As the user teaches the program about animals, the program comes to embody both the knowledge and the lack of knowledge the user can bring to it. The program provides an excellent introduction to the challenge, the fun and the pitfalls of teaching the computer. After groups have worked on the program for about an hour and managed to teach it about 20 animals, switch groups so that each group has an opportunity to try to continue to teach another group's program.
140 USE *Whatsit?* (Computer Headware)
145 REM *** *Whatsit?* is a "self-indexing, cross-referencing, data query system" that is extremely easy to use and a good transition from *Animals* to other data management programs. Its unique mode of interacting with the user is both interesting to explore and playful. For example, the user types the following query:

When's
Bob's
Birthday?

Assuming the data has been entered into the program, the computer will respond:

Bob's
Birthday's
January 1, 1980

The program provides a nice mechanism for people to get to know each other in a course or workshop. Each person can teach the program some information about him or herself that others can then discover by asking a variety of questions.
150 USE *STAR* (Nibble-Micro-Sparc, Inc.)
155 REM *** I have not actually used this program yet, but I have used similar programs, and this one looks better than those I have used. Actually, a good many programs might be used here. *STAR* stands for "Information Storage and Retrieval System." It is a small, convenient, easy-to-use data management program that is typical of larger, more complex programs. It gives the user some sense of what data management is all about. I usually ask people to construct a small data base of their own—usually a short address and phone book.
190 GOSUB 1000
195 GOSUB 2000
197 GOSUB 3000
199 RETURN
200 PRINT "PROBLEM SOLVING WITH OR WITHOUT THE COMPUTER"
230 DISCUSS Problem Solving
235 REM *** The discussion should focus on what people really do when they set out to solve real problems. The overall point to be made is that in trying to teach the computer one must engage in problem solving. Thus, working with the computer, which involves lots of problem-solving, may beneficially affect students' learning of a variety of problem solving skills.
240 SOLVE Problem 1
245 REM *** Problem 1 might be: write directions for making a peanut butter and jelly sandwich. (See "Getting Kids Ready for Computer Thinking," by Marilyn Burns, *The Computing Teacher,* Vol. 8, No. 5)

250 SOLVE Problem 2
255 REM *** Problem 2 might be: write directions for drawing a simple geometrical figure (e.g., a circle with a line through it and a dot somewhere inside).
260 SOLVE Problem 3
265 REM *** Problem 3 might be: write a complete and accurate description for playing a simple game (e.g., Tic-Tac-Toe, or Nim, or the 3 x 3 game described in Herbert Kohl's book, *Math, Writing, and Games in the Open Classroom*).
270 READ *Mindstorms* (Basic Books, 1980)
275 REM *** Seymour Papert's analysis of the potential impact of computers on our problem-solving capacities provides a useful link between problem solving in general and problem solving with LOGO.
290 GOSUB 1000
295 GOSUB 2000
297 GOSUB 3000
299 RETURN
300 PRINT "TEACHING THE COMPUTER —PHASE II—LOGO"
330 USE LOGO
335 REM *** LOGO provides an elegant, easily accessible language to begin exploring how to teach the computer by writing formal programs (LOGO is currently available for the TI 99/4 and will be available for the Apple II shortly.)
390 GOSUB 1000
395 GOSUB 2000
397 GOSUB 3000
399 RETURN
400 PRINT "TEACHING THE COMPUTER —PHASE III—THE WORLD OF GENERAL PURPOSE TOOLS"
430 USE *Gradebook* (Creative Computing Software)
435 REM *** *Gradebook* provides teachers with a tool that they may find very useful in their classrooms. It also introduces them to the world of tool programs.
440 USE *VisiCalc* (Personal Software)
445 REM *** A little experience with *VisiCalc* (an electronic accounting worksheet) can show people the immense potential of tools of this kind. An interesting problem is to use *VisiCalc* to generate the multiplication tables from one to 25 in as few steps as possible.
450 USE *D B Master* (Stoneware Microcomputer Products) or USE *Data Factory* (Micro Lab) or USE *CCA Data Management* (Personal Software)
455 REM *** Any of these data management programs (or others like them) can give the user a sense of what storing and retrieving data means. A problem such as creating a data file for recipes should lead to numerous solutions depending on the individual user's needs and culinary style.
460 USE *Apple Writer* (Apple Computer Products) or USE *Super Text* (Muse) or USE *Apple PIE* (Programma)
465 REM *** Any word processing program will do, but *Apple Writer* is one of the easiest to learn quickly. The user should have a chance to solve a few word processing problems (e.g., finding and correcting a misspelled word).
470 USE *Apple World* (United Software) or USE *E-Z Draw* (Sirius Software) or USE *Paddle Graphics* (On-Line Systems)
475 Any graphics program will do. The user should have an opportunity to explore the graphic potential of the computer and to solve some graphic problems of his or her own.
490 GOSUB 1000
495 GOSUB 2000
497 GOSUB 3000
499 RETURN
500 PRINT "TEACHING THE COMPUTER —PHASE IV—A PEEK AND A POKE AT BASIC"
530 USE BASIC

Please turn to page 40

The idea that computers can make all of us inventors and creators of our own intellectual tools is difficult to express and to understand, but it is the central idea for educational progress.

Resources

Manufacturers are listed in the order their software is used in the syllabus.

Apple Computer, Inc., 10260 Bandley Drive, Cupertino, CA 95014 (*Animals* and *Apple Writer*)

Computer Headware, P.O. Box 14694, San Francisco, CA 94114 (*Whatsit?*)

Nibble-Micro-Sparc, Inc., P.O. Box 325, Lincoln, MA 01773 (*Star*)

Texas Instruments, Inc., 6000 Denton Drive, Dallas, TX 75235 (TI *LOGO*)

Creative Computing Software, 39 East Hanover Ave., Morris Plains, NJ 07950 (*Gradebook, Music Tutor, Odell Lake*)

Personal Software, 1330 Bordeaux Drive, Sunnyvale, CA 94086 (*VisiCalc, CCA Data Management*)

Stoneware Microcomputer Products, 1930 Fourth St., San Rafael, CA 94901 (*D B Master*)

MicroLab, 2310 Skokie Valley Rd., Highland Park, IL 60035 (*Data Factory*)

Muse Software, 330 N. Charles St., Baltimore, MD 21201 (*Super Text*)

Programma, 3400 Wilshire Blvd., Los Angeles, CA 90010 (*Apple PIE*)

United Software of America, 750 Third Ave., New York, NY 10017 (*Apple World*)

Sirius Software, 1537 Howe Ave., #106, Sacramento, CA 93614 (*E-Z Draw*)

On-Line Systems, 36575 Mudge Ranch Rd., Coarsegold, CA 93614 (*Paddle Graphics*)

Beagle Brothers, 4315 Sierra Vista, San Diego, CA 92103 (*Buzzword, Textrain*)

MECC Software, 2520 Broadway Drive, Lauderdale, MN 55113 (*Music Tutor, Odell Lake*)

Sublogic, 201 West Springfield, Champaign, IL 61820 (*Flight Simulator*)

AN INSIDE LOOK AT INSERVICE

Lessons Learned on the Inservice Trail

by Don G. Rawitsch

Since 1974, the Instructional Services staff of the Minnesota Educational Computing Consortium (MECC) has spearheaded Minnesota's drive to become the most active classroom computing state in the nation. MECC has operated a statewide instructional timeshare system for seven years, has established purchase contracts for microcomputers, and has developed and distributed quality software. Perhaps the most important part of MECC's program, however, has been inservice training, for without face-to-face instruction presented in a non-threatening way, most teachers would neither become nor remain computer users.

A team of 10 instructional coordinators, each assigned to serve a specific geographic area of public school districts and colleges, carries out MECC's training program. Half the team works out of MECC's Twin Cities office, while the other five members live closer to the schools they serve. The instructional coordinators visit schools, offer workshops and classes, make informational presentations, hold regional conferences, publish newsletters, provide over-the-phone consultation and produce training materials for use in local-level inservice activities. In a given year, this team will chalk up 700 visits, 200 workshops, 20 classes, 400 presentations and eight conferences with an average attendance of 300 teachers and students. Since 1974, MECC staff members have presented about 2000 workshop sessions alone.

The Trainer's Tribulations

During the course of this major inservice effort, we have faced several significant issues. One that I'm sure anyone charged with similar responsibility has confronted is that the demand for training quickly surpasses the supply of trainers. Educators at all levels have become interested in instructional computing. Of those responding to the 1981 MECC Statewide Computing Opinion Survey, 80 percent indicated a very high need for training. To help meet this need, we have had to balance the three approaches of offering regularly scheduled events, trying to respond to individual requests for service and urging institutions to set up mechanisms for their own follow-up training. We've established special services, such as a series of multi-session classes on the Apple II microcomputer, to give people more in-depth training than one- or two-hour workshops can provide. A well-established schedule of classes, meetings for local computing resource people and visits to school sites should allow staff to cover the training needs of as many users as possible within the finite amount of available staff time.

Because a central support staff cannot personally reach every educator, an effective network of local people is critical to efficient inservice training.

How to establish the most effective support network for our teachers is another problem. Because a central support staff cannot personally reach every educator, an effective network of key, local support people is critical to maintaining an efficient inservice effort.

MECC has urged school districts and colleges to appoint one computing liaison who can pass information to and work with other staff members. This arrangement greatly eases the job for the MECC coordinators, each of whom covers 50 or so institutions. Some districts can't afford to release a staff person for the amount of time this job needs, however, and so have named a computing contact person for each building.

How to Teach about Computing

A third major issue involves how educators should be taught about computing. Too often, trainers design sessions in the mold of computer science courses more properly geared for training computer professionals. Inservice activities for educators must recognize that the participants have little or no computer background, but do have a broad background to which many aspects of computing can be related. Such sessions must present computing as a helpful process, not as an academic discipline. They should focus primarily on the computer's relationship to instruction, not on the computer as an object of study. MECC staff attempt to keep these principles in mind when designing inservice activities.

Much of what MECC staff has learned during seven years of training educators relates to how individuals can most effectively carry out the role of trainer. But a few things reflect organizational concerns. For one thing, we feel much can be said in favor of a centralized approach to statewide training. Having a team of staff members working together, supporting each other and sharing knowledge has provided benefits that surpass those that would have been possible had individuals worked for separate organizations. Our conscious policy of limiting the types of computer systems we support has also helped enormously. For the first years, the staff supported only a timeshare program. With the advent of microcomputers, we initiated a bidding process and chose only one computer, the Apple II, to support. MECC plans to support a lower-cost alternative in the future, but only after we've made specific decisions as to the nature of that support and the extent to which the current systems will continue to receive attention. By concentrating a thorough inservice effort on fewer alternatives, we have developed a higher quality program and have kept staff from being spread too thin.

MECC's large quantity of software and support materials includes several

products of specific interest to those involved with inservice training for the Apple II microcomputer: New User's Guide, Demonstration Diskette of Instructional Applications and a series of training booklets for people presenting classes to educators. For a free catalog and price list of all MECC publications, write: MECC Publications, 2520 Broadway Drive, St. Paul, MN 55113. □

Don G. Rawitsch is manager of user services for the Minnesota Educational Computing Consortium, St. Paul, Minnesota.

The PET Shoppe at B.E.S.T. Center

by Jack Turner

Jan Mazur

Our Bethel-Eugene-Springfield Teacher Center (BEST Center) works with over 2000 teachers from three cooperating school districts in western Oregon. All three districts have made system commitments to microcomputers in the classroom across all grade levels, so BEST Center has received an increasing volume of requests over the past two years from area teachers who need training or assistance with microcomputers. Eugene and Springfield, by far our largest districts, committed themselves to PET microcomputers while Bethel opted for the Apple II. By the end of the 1980-81 school year approximately 120 PETs and eight Apples were in various classrooms across the BEST Center service area.

The BEST Center Policy Board decided to add instructional microcomputing as one of the Center's special focus areas last summer because we realized that while our districts were acquiring lots of computers, they had no low-risk source of training and support. Teachers generally faced three choices for learning about computers, but each was accompanied by perceived liabilities. They could enroll in a conventional computer course at the University of Oregon, but that implied extended time commitment, grades and perhaps worst of all, suspicions of inadequacy confirmed. They could frequent local computer stores, but that implied jargon and blandishments from the seller. Or, finally, they could attend one of the infrequent group training sessions sponsored by the districts, but that produced frustration because participants always felt pressured to give someone else a chance to have three minutes in front of the machine.

When BEST Center chose to provide training, the staff made two corollary decisions. We would not herd teacher-learners into groups that outnumbered the computers available to learn with. And we would spend as much time on developing sensitivity to instructional program quality issues as possible. Given those limiting propositions we are not able to train impressive numbers of teachers during the school year. BEST Center has only two computers, an Apple II owned by the director and a 16K PET on loan from the Eugene district.

Establishing the PET Shoppe

In mid-winter, I decided that we might "store" a large number of district-owned microcomputers for the summer, thereby allowing BEST to invite larger numbers of teachers to learn at a more leisurely pace over summer vacation. We arranged to use a business education classroom as our "PET Shoppe" because it had 25 electrical outlets and was furnished with typewriter tables. After counting the outlets we approached the largest district to advance the unusual summer storage proposal. They agreed to provide 25 PETs on loan from late June through mid-August on the condition that BEST Center would pay normal maintenance or repairs if we broke a machine.

Once the machines were promised came the challenge of how to afford the widest range of users something of value—a reason to forgo precious summer vacation time no matter what their previous experience with microcomputers. We designed two classes for the afternoon periods: an entry level course for teachers with no previous experience and a BASIC programming course whose content began where the entry level course left off. These two classes were to be conventional-looking, 3-credit-hour, university-approved courses, yet they were distinct in important ways. Both were taught by a junior high level teacher who, although holding a master's in computer science, remembers full well how it felt to be intimidated by a machine. And all content focused on classroom instructional matters. (I suspect that teachers who have enrolled in BASIC programming courses only to spend much time learning to program mailing lists will appreciate this narrow focus.)

The mornings from 9:00 till noon were open lab; any educator was welcome to drop in for an hour, a week or whatever fit the individual need. The center arranged to have a lab supervisor present at all times, trained to give help if requested or to be inconspicuous if not. The five lab supervisors were local teachers, already competent with computers, who came in one morning per week. We had the BEST Center collection of instructional programs available for review and laid out extensive print material—periodicals, software catalogs and reviews, programming aids, etc. The morning open lab resembled my version of a perfect school: participants present and motivated (if sometimes anxious); much help and sharing sought and given; and a palpable sense of "Aha!" as learners over-

Please turn to page 41

P O E T

A PROGRAM FOR WORD PEOPLE

by Lloyd R. Prentice

The long river . . .
A sea shakes of still violet
Dappled dew

A damp glitter;
The shadow has risen under wispy sunset
Little rain

by My Computer

There's no reason why the folks in the math department should have all the fun. Here is a program for your school's Atari 400 or 800 microcomputer that will enrich your language arts classes. The program, POET, "creates" Haiku poetry. It will create as many completely original poems as you'd like and more: it may be easily modified to create other poetic forms. It may even be coaxed to produce such non-poetic expressions as insults and aphorisms. Indeed, with modification and experimentation, it could become the basis for a student laboratory in expressive communication.

There are many ways that you can use POET in your classes. You can use it as the basis for discussions on the nature of the creative process. You can look at the relationship between form and meaning. You can generate seed lines to stimulate your students' creativity. You can generate examples for critical review. I've used POET in teacher workshops and provoked wonder, amusement and even mild outrage that computers should dare enter the poet's province. Mostly, I have provoked heightened respect for the potential of the computer as a learning tool.

How POET Works

POET is based on six dictionaries contained as DATA statements within the program. Here are the locations of each dictionary in the program:

Dictionary	Line No.	Content
1	1000	articles
2	2000	adjectives
3	3000	nouns
4	4000	verbs
5	5000	prepositions
6	6000	punctuation

When you list the program, you'll notice that the first data element in each dictionary is the number of words in that particular list. There are 50 adjectives, for example, and 14 verbs. You can change the words in the dictionaries by editing the corresponding DATA statements. If you change the number of words in a given dictionary, be sure to update the number at the beginning of the list. By changing the words in the dictionaries, you can change the content of the poems or expressions created.

Lines 31 through 34 determine the form of the poems created by POET. The number in line 31 tells the computer how many lines to generate for each poem. This is presently three. Lines 32 through 34 give the syntactical pattern for each line. The first number in each syntactical DATA statement tells the computer how many words to select for that particular line. The remaining numbers in the statement tell the computer which dictionary to use in selecting the respective words in the line. Line 33 tells the computer, for example, to select six words in the following syntactical sequence: article (dictionary 1), noun (dictionary 3), verb (dictionary 4), preposition (dictionary 2), noun (dictionary 3). The computer creates a poem by selecting words at random from the appropriate dictionary according to the syntactical patterns given in DATA statements between lines 31 and 50 in the program.

POET has provoked wonder, amusement and even mild outrage that computers should dare enter the poet's province.

If you wish to experiment with this program, I suggest you start by changing the words in the verb dictionary. The verbs that you choose will change the quality of the poetry considerably. Why not have students suggest verbs to try? When you change the words in a dictionary, just be sure that the number at the beginning of the list is the same as the number of words in the list and that the syntax conventions for a BASIC DATA statement are observed. Once you feel that you understand how to change the words in a dictionary, try changing the syntax of a particular line. If you change line 34 to:

```
34 DATA 3,1,2,3
```

for example, the syntax of the last line of each poem will be article, adjective, noun. Finally, you can change the number of lines generated by POET by changing the number in line 31 to the number of lines you would like and by adding a DATA statement specifying the syntax for each new line. These DATA lines can go in the space provided in the program between lines 31 and 50.

I hope that you enjoy POET as much as I have. I'd love to hear about the creative applications you find for POET in your classroom. If you'd like an Apple II or Commodore version of POET, please send a stamped, self-addressed envelope to me at *Classroom Computer News*, P.O. Box 266, Cambridge, MA 02138.

POET was inspired by HAIKU, a program for the Radio Shack TRS-80 from John Krutch's fine book *Experiments in Artificial Intelligence for Small Computers* (Howard W. Sams, Indianapolis, 1981). If you have a Radio Shack computer, John Krutch's book will give you a listing that you can run.

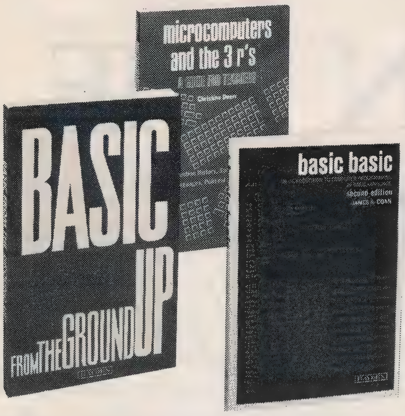
The POET Program

```
10 REM *********POET
11 REM *********BY Lloyd R. Prentice
12 GRAPHICS 0:POSITION 2,20
13 POKE 752,1
14 FOR I=1 TO 30
15 PRINT "            POEM"
16 NEXT I
17 PRINT "                   by Lloyd R.
Prentice"
18 PRINT :PRINT :PRINT :PRINT
19 FOR I=1 TO 500:NEXT I
20 REM ****Reserve memory space
21 REM ****Space for words and
lines
22 DIM WORD$(20),LINE$(200),L$
```


信

```
(200),Y$(1)
23 REM ****Space for pattern
24 DIM PATTERN(10,10)
25 REM
30 REM ****Data for pattern
31 LET NUMBLINE=3:REM Number
of lines
32 DATA 4,1,2,3,6
33 DATA 6,1,3,4,5,2,3
34 DATA 2,2,3
35 REM
50 REM ****Read pattern into
memory
60 FOR LINE=1 TO NUMBLINE
70 READ NUMBWORD
80 LET PATTERN(LINE,0)=NUMB
WORD
90 FOR WORD=1 TO NUMBWORD
100 READ TEMP
110 LET PATTERN(LINE,WORD)=
TEMP
120 NEXT WORD
130 NEXT LINE
140 REM
200 REM ****Create line
210 FOR LINE=1 TO NUMBLINE
220 GOSUB 300:REM Part of speech
230 NEXT LINE
240 PRINT :PRINT :PRINT
250 PRINT "Another poem (Y/N)";
260 INPUT Y$
270 IF Y$<"Y" THEN 290
275 GRAPHICS 0:POKE 752,1
280 POSITION 0,15:PRINT ""
285 GOTO 200
290 END
300 REM ****Part of speech
310 LET NUMBWORD=PATTERN(LI
NE,0)
320 FOR WORD=1 TO NUMBWORD
330 LET DICT=PATTERN(LINE,WOR
D)
340 GOSUB 500:REM Choose diction
ary
350 GOSUB 700:REM Dice
360 GOSUB 800:REM Choose word
370 GOSUB 900:REM Create line
380 NEXT WORD
390 REM
400 REM ****REM Print line
410 GOSUB 10000:REM Fix articles
420 PRINT LINE$
430 LET LINE$=""
440 RETURN
450 REM
500 REM ****Choose dictionary
510 IF DICT=1 THEN RESTORE 1010
520 IF DICT=2 THEN RESTORE 2010
530 IF DICT=3 THEN RESTORE 3010
540 IF DICT=4 THEN RESTORE 4010
550 IF DICT=5 THEN RESTORE 5010
560 IF DICT=6 THEN RESTORE 6010
570 READ LIMIT
580 RETURN
590 REM
700 REM ****Dice
710 LET DICE=INT(RND(0)*100)
720 IF DICE<1 OR DICE>LIMIT TH
EN 710
730 RETURN
740 REM
800 REM ****Choose word
810 FOR POINTER=1 TO DICE
820 READ WORD$
830 NEXT POINTER
840 RETURN
850 REM
900 REM ****Create line
910 LET END=LEN(LINE$)+1
920 LET LINE$(END,END+1)=" "
930 IF PATTERN(LINE,WORD)<>6
THEN LET END=END+1
940 LET LINE$(END,END+LEN(WOR
D$))=WORD$
950 RETURN
960 REM
1000 REM ****Article dictionary
1010 DATA 3,A,THE,AN
1020 REM
2000 REM ****Adjective dictionary
2010 DATA 50,AUTUMN,HIDDEN,BI
TTER,MISTY,SILENT,EMPTY
2020 DATA DRY,DARK,SUMMER,
ICY,DELICATE,QUIET
2030 DATA WHITE,COOL,SPRING,
WINTER,DAPPLED
2040 DATA TWILIGHT,DAWN,CRIM
SON,WISPY,AZURE
2050 DATA BLUE,BILLOWING,BRO
KEN,COLD,DAMP,FALLING
2060 DATA FROSTY,GREEN,LONG,
LATE,LINGERING,LIMPID
2070 DATA LITTLE,MORNING,MUD
DY,OLD,RED,ROUGH
2080 DATA STILL,SMALL,SPARKL
ING,THROBBING,VERMILLION
2090 DATA WANDERING,WITHERE
D,WILD,BLACK,YOUNG
2100 REM
3000 REM ****Noun dictionary
3010 DATA 50, WATERFALL,RIVER,
BREEZE,MOON
3020 DATA RAIN,WIND,SEA,MORNI
NG,SNOW,LAKE,SUNSET
3030 DATA PINE,SHADOW,LEAF,
DAWN,GLITTER,FOREST
3040 DATA HILL,CLOUD,MEADOW,
SUN,GLADE,BIRD,BROOK
3050 DATA BUTTERFLY,BUSH,DEW,
DUST,FIELD,FIR
3060 DATA NIGHT,POND,SHADE,SN
OWFLAKE
3070 DATA SILENCE,SOUND,SKY,
SHAPE,SURF,THUNDER
3080 DATA VIOLET,WATER,WILDFL
OWER,WAVE
3090 DATA FLOWER,FIREFLY,FEAT
HER,GRASS,HAZE,MOUNTAIN
4000 REM ****Verb dictionary
4010 DATA 14,SHAKES,DRIFTS,HAS
STOPPED,STRUGGLES
4020 DATA HAS FALLEN,HAS PAS
SED,SLEEPS,CREEPS
4030 DATA FLUTTERS,HAS RISEN,
IS FALLING,IS TRICKLING
4040 DATA MURMURS,IS FLOATIN
G
4050 REM
5000 REM ****Preposition dictionary
5010 DATA 6,ON,IN,OF,UNDER,OVE
R,NEAR
5020 REM
6000 REM ****Punctuation dictionary
6010 DATA 2,...,;
6020 REM
10000 REM ****Fix articles
10010 FOR I=1 TO LEN(LINE$)-2
10020 IF LINE$(I,I+2)=" A " THEN Y$
=LINE$(I+3,I+3)
10030 IF Y$="A" OR Y$="E" OR Y$=
"I" OR Y$="O" OR Y$="U" THEN
10050
10040 GOTO 10080
10050 LET L$=LINE$(I+2,LEN(LINE$))
10060 LET LINE$(I+2,I+2)="N"
10070 LET LINE$(I+3,LEN(LINE$)+1)=
L$
10080 LET Y$=""
10090 NEXT I
10100 FOR I=1 TO LEN(LINE$)-4
10110 IF LINE$(I,I+3)<>" AN " THE
N 10160
10115 LET Y$=LINE$(I+4,I+4)
10120 IF Y$="A" OR Y$="E" OR Y$="
I" OR Y$="O" OR Y$="U" THEN 1016
0
10130 LET L$=LINE$(I+3,LEN(LINE$))
10140 LET LINE$=LINE$(1,I+2)
10150 LET END=LEN(LINE$)
10155 LET LINE$(END,END+LEN(L$)
)=L$
10160 LET Y$=""
10170 NEXT I
10180 RETURN
```

HAYDEN TEXTS PUT THE WORLD OF MICROCOMPUTERS AT STUDENTS' AND TEACHERS' FINGERTIPS!

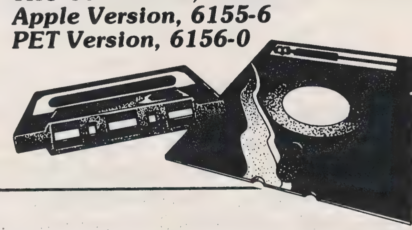


MICROCOMPUTERS AND THE 3 R'S (Doerr) "I highly recommend Microcomputers and the 3R's as a text for preservice and inservice teacher education. . . . a valuable personal reference book for a secondary school teacher, not only to read once, but to use again and again . . . *Computer Using Educators.* Educates teachers on how computers, specifically microcomputers can be used in the classroom. Describes how to organize a computer-based program, the five instructional application types, and resources listings of today's products. Provides a course syllabus and teaching notes for a 6 week introductory course on computers and BASIC. ***#5113-1, $8.85***

New! **I SPEAK BASIC** (Jones) A field-tested computer literacy course for junior high school students, requiring NO PREVIOUS COMPUTER EXPERIENCE for teachers! This complete one-semester program is machine specific and introduces students to BASIC programming. Teacher's Manual has annotations for lesson planning. Student text features learning objectives, program definitions and examples, group activities and exercises. Quizzes, provided on spirit duplicating masters, check student understanding of key concepts.
Teachers' Manuals, $12.95 each:
TRS-80 Version, 6164-1
Apple Version, 6165-X
PET Version, 6166-8
Student Text, $5.95:
TRS-80 Version, 6174-9
Apple Version, 6175-7
PET Version, 6176-5
Exam Set, $10.00 each:
TRS-80 Version, 6184-6
Apple Version, 6185-4
PET Version, 6186-2
Complete Sets, $125.00 each:
Teacher's Manual,
20 Student Texts, Exam Set:
TRS-80 Version, 6154-4
Apple Version, 6155-6
PET Version, 6156-0

BASIC BASIC: AN INTRODUCTION TO COMPUTER PROGRAMMING IN BASIC LANGUAGE, Second Edition (Coan) ". . . an excellent introduction to the use of BASIC . . . clearly written and well-organized." *Computing Reviews.* Over 100 sample programs to present the essential statements of BASIC. Each new language statement or capability is clearly explained at the time that it is first used in a sample program. Practice problems follow every section. Solutions to even-numbered problems appear in the text, the remainder are in the separate Teacher's Guide. ***#5106-9, paper, $10.50; #5107-7, cloth, $13.95; #5108-5, Teacher's Guide, paper, $1.40.***

BASIC FROM THE GROUND UP (Simon) A BASIC text for high school students and hobbyists that explores computers and the BASIC language in a simple direct way, without relying on a heavy mathematical background on the reader's part. Includes all features of BASIC, as well as some of the inside workings of a computer. A selection of exercises and six worked out problems round out the reader's experience. A glossary and summary of BASIC statements appear at the end of the book for reference. ***#5760-1, paper, $10.75.***



Educational Software From Hayden

GENERAL MATHEMATICS-1 (Gilder) Contains 15 programs useful to anyone who wants to improve their math skills and accelerate their computation. ***#01101, PET: #01103, TRS-80 Level II; #01104, Apple II; #01105, Sorcerer; each tape, $14.95***

CROSSBOW (Breitenbach) Features a target game that, besides offering hours of fun, teaches fractions in an exciting and competitive environment. An educational program for all ages. ***#02701, PET tape, $9.95***

MICROTYPING (Engel) Features the "touch method" of learning to type for improving your computer skills. ***#02401, PET; #02403, TRS-80 Level II; #02404, Apple II; each tape, $10.95***

COMPLEX MATHEMATICS (Gilder) Contains 8 programs that give the user the ability to perform computations of complex numbers in BASIC rather than in FORTRAN. ***#01201, PET: #01203, TRS-80 Level II; #01204, Apple II; each tape $14.95***

ORDER NOW!

Hayden Book Company, Inc.
50 Essex Street, Rochelle Park, NJ 07662

Please send me the book(s) checked on 15 day FREE examination. At the end of that time, I will send payment, plus postage and handling, or return the book(s) and owe nothing. On all software orders, payment or Visa / Master Card charge account numbers must accompany all orders. On all prepaid orders publisher pays postage and handling. I can return any disk or tape within 10 days if it is defective or I am not completely satisfied. Residents of NJ and CA must add sales tax. Offer good in USA only. Allow 4 to 6 weeks for delivery. Name of individual ordering must be filled in. Payment must accompany orders from PO Box Numbers.

☐ 5113-1	☐ 6155-2	☐ 01203
☐ 5106-9	☐ 6156-0	☐ 01204
☐ 5107-7	☐ 01101	☐ 02401
☐ 5108-5	☐ 01103	☐ 02403
☐ 5760-1	☐ 01104	☐ 02404
☐ 6154-4	☐ 01201	☐ 02701

Name ____________________
Address ____________________
City / State / Zip ____________________

CCN 9/81-077

Available at your local computer store!

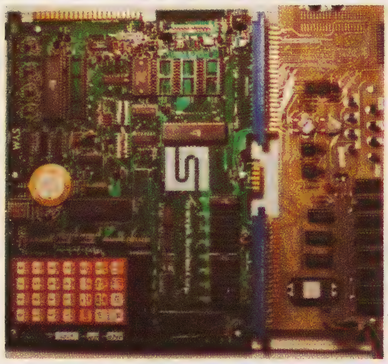
For Orders and Inquiries Call Toll Free

HAYDEN HOTLINE 800-631-0856

Hayden Book Company, Inc.

50 Essex Street, Rochelle Park, NJ 07662

COMPUTERS IN THE SCIENCE LAB



Jeffrey Katz

by Robert Tinker and Tim Barclay

While computers have many uses in science education, their use as laboratory instruments has been largely overlooked. For twenty years of educational experimentation with computers, science educators have primarily used time-share mainframe computers, which cannot conveniently perform real-time measurements. This represents a great loss since computers can simplify the gathering, transforming and displaying of scientific data. In many cases, this power can permit students to interact much more actively and profoundly with the real world.

The arrival of microcomputers has completely changed the hardware situation. Many laboratory applications of computers require very little computation and place only minimal requirements on the computer. As a result, very simple and inexpensive microcomputers can be successfully used in the laboratory.

The computer with a laboratory interface is a powerful and flexible instrument. Using a graphical output to display results that it has accumulated, it becomes a storage oscilloscope. Using the timing capabilities that are inherent in all computers, it can be a timer that measures the time between external events, or a frequency counter that counts the number of external events in a fixed period of time. By simply displaying the voltages and currents that it senses, it becomes an ammeter or a voltmeter.

Because these functions can be part of a single computer, they can be combined to create versatile measurement and control systems. The computer can also transform the data it gathers into forms such as graphs that are meaningful and easy to interpret for students.

Such applications of microcomputers can improve the teaching of science as well as convey an appreciation of the process of scientific investigation. For example, the standard cooling curve experiment can easily be performed in a few minutes with a microcomputer equipped with two thermal transducers (sensors), because a microcomputer can take data rapidly from even a small sample. What is usually a single, laborious experiment can now yield temperature and heat flow data and can be repeated numerous times under different conditions in one class period. Students' attention can be more easily directed to the phenomena of phase transitions because the computer has assumed the tedious and distracting data gathering, analyzing and displaying chores.

As a by-product of running this experiment, students also learn some powerful and easily generalized measurement skills. By changing the sensor and the data sampling rate, they can use the same techniques to record high-speed multiple lightning flashes or slowly varying meteorological data. Thus, after some practice, students can realistically adapt these techniques to perform their own investigations. We feel this is very important, because only by being the experimenters can students begin to understand the process of science.

The Computerized Lab

Our group at Technical Education Research Centers, Cambridge, Mass., began experiments four years ago with application of microcomputers in the laboratory because we were writing course materials for a project designed to prepare students for jobs

using laboratory instruments. We realized from the beginning that no such course would be complete without a fairly thorough coverage of microcomputer applications in instrumentation; research labs that are not already heavily dependent on computers for gathering and analyzing data will certainly become so by the time the current generation of students is on the job for any length of time.

We developed numerous applications, all using a simple, single-board microcomputer. These applications include:

- *Counter/Timer:* In this program, the counter displays or counts elapsed time. It has all the functions of a normal counter/timer but with a lower frequency response. In addition, it can record for later recovery the number of times that multiple events happened after an initial trigger period.
- *IC Testing:* This convenient program "learns" the logic expected from an integrated circuit (IC) by running through the permutations of a functioning IC and then comparing this to questionable ones.
- *Function Generator:* Using an analog output, this program generates a variety of functions that one would expect from only a very sophisticated function generator. It offers ten different functions, including white, pink and blue noise with selectable amplitude, offset and frequency.
- *Transient Recorder:* This program triggers when the transient starts and displays the results on a standard oscilloscope, thus effectively converting it to a storage-type oscilloscope.
- *Fourier Synthesis:* This program uses the idea behind the transient recorder to capture an input waveform, which is then frequency analyzed. Using a Fast Fourier Transform algorithm, the computer displays the power content of the first 128 frequencies in the captured signal.
- *Radioactive Half-life Experiment:* Here, pulses from a Geiger Tube are counted over time and the resulting half-life decay function is displayed on an oscilloscope.
- *Pulse Height Analysis:* This program uses a special interface to capture the height of pulses from a standard photo-multiplier height spectrum detector. The resulting pulse height spectrum is then displayed on an oscilloscope.
- *The Computer of Average Transients:* We have developed a geological sounding experiment that requires careful processing of signals generated by a geophone that detects seismic waves generated by hitting the ground. The common technique is to use a computer of average transients, which our simple program simulates.
- *Solar Collector Analysis:* Temperatures from a number of sensors distributed around a solar collector and light levels measured by a light detector are simultaneously logged and selectively displayed through use of this program.
- *Rotational Dynamics:* This program measures the angular acceleration of a disk commonly called for in lab experiments involving rotational dynamics.

Courtesy of Cambridge Development Lab

Microlab, developed by TERC, is now marketed by Cambridge Development Laboratory.

Cost No Problem

Our work suggests the wide range of applications possible for computers in the science lab. With the advent of microcomputers and the development of increasingly sophisticated integrated circuits, the cost is no longer prohibitive. A school already having access to a computer can add laboratory interfacing using a circuit having a total component cost of under $20. And we have every reason to believe that the trend toward decreasing costs of lab interfacing will continue into the future: a microcomputer chip that has most of the required circuitry on a single, inexpensive integrated circuit already exists.

Lab-interfaced microcomputers have the potential of dramatically improving students' learning and attitudes toward math, science and engineering. They can do this by providing easy access to a wide range of physical phenomena; by presenting fast feedback in attractive, meaningful visual formats; and by giving students the capability of performing their own experiments. We feel that lab-interfaced microcomputers, when properly used, can provide an important tool for science instruction by greatly strengthening and deepening students' laboratory experiences and by permitting them much more detailed and sophisticated direct experiences with natural phenomena than were previously thought possible. □

Robert Tinker and Tim Barclay, both on the staff of Technical Education Research Centers (TERC), Cambridge, Mass., are, respectively, director of the Technology Center and staff associate in the Computer Resource Center. Parts of this article were previously published in the spring 1980 issue of Hands On, *TERC's newsletter.*

Sources for lab interfaces for microcomputers:

Cambridge Development Labs
36 Pleasant St.
Watertown, MA 02172

Connecticut microComputer, Inc.
34 Del Mar Drive
Brookfield, CT 06804

Pasco Scientific
1933 Republic Ave.
San Leandro, CA 94577

CONDUIT

A Pipeline to Better Educational Software

by Molly L. Hepler

CONDUIT is an elder statesman of the educational computing field. Begun in 1969 as an experiment in moving instructional materials from one institution to another, it has evolved into an organization that reviews, tests, packages and distributes these materials. Its activities center on the primary goal of improving instruction by delivering proven computer-based learning materials to educators.

CONDUIT'S primary audience is and always has been higher education. However, as microcomputers have brought computer-based education into a vast number of secondary schools, and as CONDUIT has begun modifying its mainframe and minicomputer software to run on microcomputers, more and more high schools have begun using CONDUIT programs. Today, CONDUIT materials written in BASIC are available for Apple II, Commodore PET 2001 and Radio Shack TRS-80 microcomputers. In the near future, CONDUIT plans to begin distributing units written for the Atari 800.

CONDUIT does not actually develop computer-based materials for instruction; rather, it distributes materials others have developed. Its authors are typically college or university faculty who have created materials based on their own teaching experiences and who have used those materials with their students.

Above all, CONDUIT seeks *quality* materials. Quality is of course difficult to define, but CONDUIT relies on an operational definition: if peer review panels judge materials to be substantively correct and of evident educational effectiveness, then CONDUIT considers them of requisite quality.

The CONDUIT Review Process

During Conduit's experimental phase (1969-1973), it developed a review form for evaluating instructional computer-based materials. The form was designed by experts in several areas—designing forms, evaluating instruction and using computers as instructional tools—and then field tested to ensure its reliability. The first step in CONDUIT's review process is to have the materials examined and used in the classroom by educators with experience in the content area and in using computer-based materials. Evaluations of the materials using this review form help determine the conceptual validity, instructional usefulness and overall quality of each unit. The recommendations and suggestions from the reviews are then incorporated into the materials. Outstanding educators in each discipline coordinate these reviews and advise CONDUIT concerning the educational elements of the unit.

Once a unit has passed the substantive peer-review process, the CONDUIT staff then reviews each program for accuracy and prepares the program so that it can be easily installed and used on a variety of computers (both large and small, batch and interactive, in BASIC and FORTRAN).

The Materials

The CONDUIT library now includes 148 units to help teach biology, chemistry, economics education, geography, Spanish, English, management science, psychology, sociology and statistics. The units will operate on a variety of computers: 30 units are written in FORTRAN and 54 units in standard BASIC for large computers; 23 units are available for the Apple II, 13 units for the PET 2001 and 16 units for the TRS-80 (Model 1).

CONDUIT believes one of the most necessary requirements for any learning package to be widely adopted and used is complete supporting documentation. Each CONDUIT unit includes manuals for the instructor as well as for the students. The instructor's manual provides all the information needed to easily incorporate the materials into the existing curriculum. The student's manual prepares and guides the student through the exercise, helping him or her gain the maximum benefit possible.

The materials use computers to enrich instruction in a variety of ways. Several simulate situations that are impossible or too expensive to reproduce in a laboratory. Others help teach quantitive techniques used in linear algebra, calculus, operations

management, ecological modeling, quantum mechanics and comparative politics. Some provide problem-solving tools or data for students' investigations. Other packages provide drill and practice in essential skills or act as a tutor for students learning important concepts.

Although many of the units are designed for collegiate instruction, some are also being used today at the high school level, particularly for enrichment studies for juniors and seniors. Other units, such as *Algebra Drill & Practice I and II* and *Practicando Español* are being used to tutor students.

The packages *Algebra Drill & Practice I and II*, for example, enable schools to provide drill, practice and help for students of algebra. The drills provide students with virtually unlimited numbers of example problems and their detailed, step-by-step solutions. Together, the two packages cover most of the topics included in an elementary algebra course, as well as some pre-algebra topics that beginning students have difficulty mastering. *Practicando Español* also offers comprehensive drill-and-practice activities, with three programs on verb forms and one on vocabulary.

A Research and Development Center

CONDUIT is continually studying ways to make instructional computing more effective. It considers all aspects of computer-based materials important: design, development, style, packaging and classroom use. Present activities include research and development of aids for authors, programming and transfer standards, and evaluations tools.

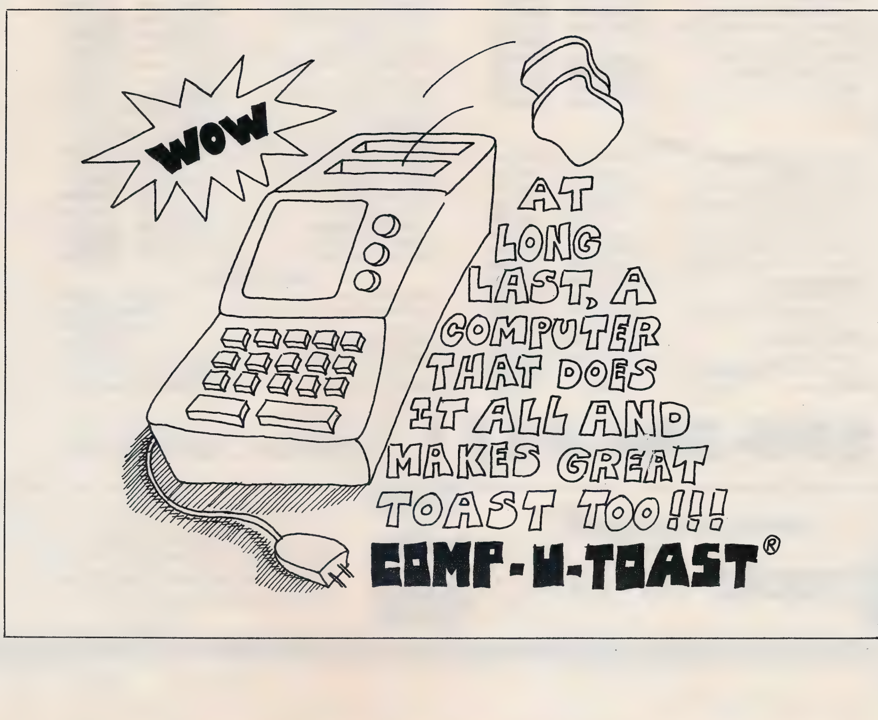
> ***Do graphics enhance computer-based instruction? Does audio? Color?***

Current funding from the National Science Foundation supports CONDUIT's research into the educational value of various features available on microcomputers. Do graphics enhance computer-based instruction? What about full-color output? Or audio? Or joysticks? The automatic, but unsubstantiated, response is often yes. While these features have been available for some time, the equipment to use them has been prohibitively expensive. For most of us, the questions have remained academic. But the availability of inexpensive microcomputers changes all that. CONDUIT is formally investigating the nature of these techniques and attempting to determine under what circumstances they do in fact make a difference.

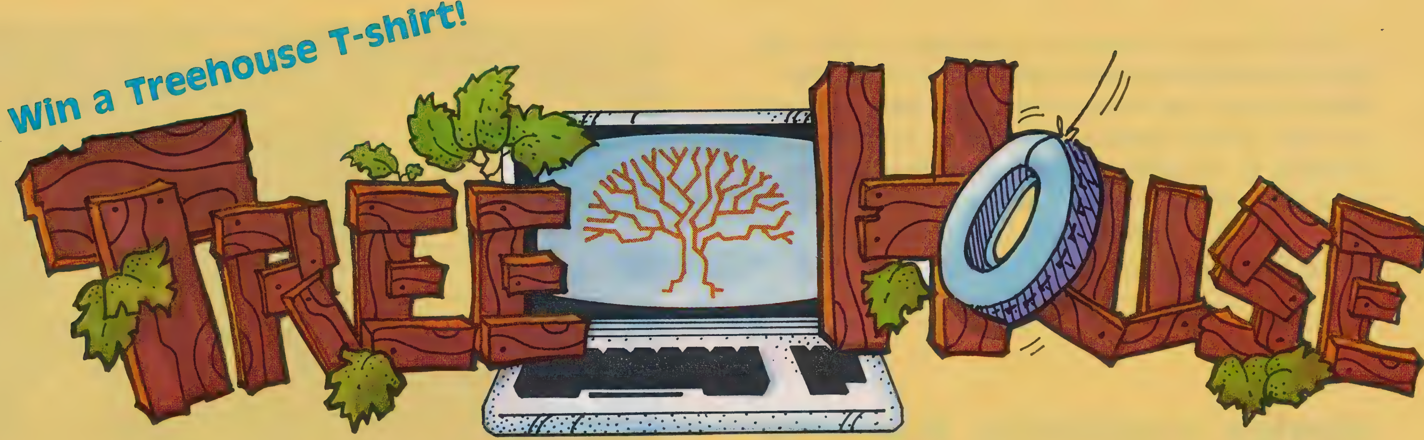
A second project underway at CONDUIT is supported by the Fund for the Improvement of Post-secondary Education. In this project, 35 instructional units will be identified, reviewed, tested and distributed for several different microcomputers over the next three years. An indirect but equally important goal of the project is to evolve and disseminate guidelines for developing microcomputer-based materials. Through helping authors share materials and approaches to development, CONDUIT hopes to spur development of instructionally sound and widely useful computer-based materials.

The information and materials CONDUIT distributes are available to all interested educators. For more information about CONDUIT, its materials and activities, contact: CCN Dept., CONDUIT, P.O. Box 388, Iowa City, Iowa 52244; 319/353-5789. □

Molly L. Hepler is editor of Pipeline, *CONDUIT's biannual publication.*



Steve Lynch



What do you get when you cross a computer with a monkey wrench?

A ROBOT!

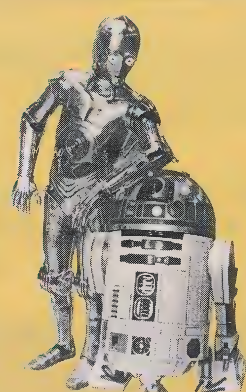
So what is a robot, anyway?

It looks like a snake. It slithers and climbs. It can coil around a person. But it's made of metal and wires and it has a computer for a brain. It's a special kind of ROBOT! It was invented to help clean inside giant machines.

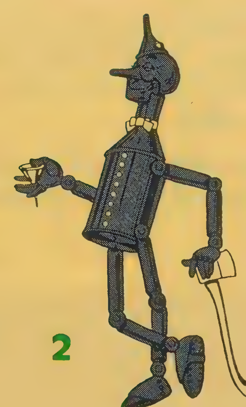
Most people would say that a robot is a machine that looks and acts like a person. But the robots that work in offices, factories, under the sea or in outer space seldom look like people or like the robots in movies. And scientists say it will be years before robots are half as clever as Luke Skywalker's friend R2-D2.

What is a robot if it can look more like a snake than a person and if it's not as smart as robots in books and movies? Basically, it is an intelligent machine. It is a computer with motors, levers, gears, supports and grippers attached to it. It can sense the world around it. It can work with its arms and grippers.

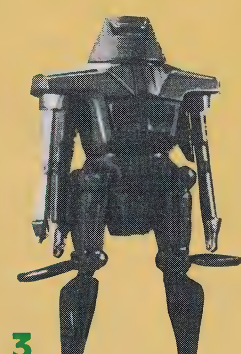
R2-D2, C-3PO and Maximillian are all made up by science fiction writers. Think of an idea for a science fiction story with a robot as one of the characters. Write a paragraph telling what the robot is like. What does it look like? What can its computer brain do? How does it act around people and around its fellow robots? What role will it play in the story?



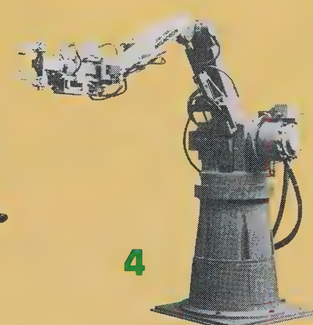
1



2



3



4

Look at the pictures above. Which one would you choose if . . .

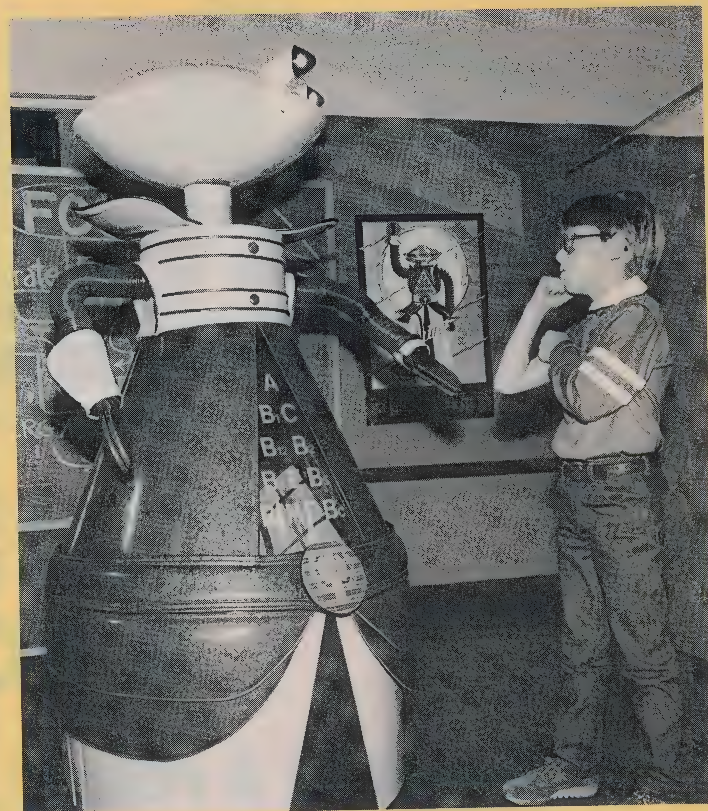
_____you had to find a wizard.

_____you had to save a princess.

_____you had to build 100,000 automobiles a year.

_____you had to protect your spaceship from intruders.

What makes a machine intelligent? The ability to remember and to make decisions. An alarm clock can remember what time to wake you up. It can decide whether or not the time is right. It certainly shows more intelligence than a hammer. A computer is more intelligent yet. It can remember millions of things and make thousands of decisions every second.



Rick Friedman/Picture Cube

Robot Teacher? Nutro, a robot teaching machine, helps students learn how good nutrition builds strong muscles.

How robots think

A computer makes a robot different from an ordinary machine. The computer tells the robot's other parts what to do. The computer might turn on a motor to move the robot's arm. Then it might turn on another motor to grip something with the arm. In simple robots, humans write the instructions, or *program,* for the computer. More intelligent robots program themselves!

Imagine a simple robot programming language. "MOVE ARM RIGHT 60 DEGREES" makes the robot arm move 60 degrees to the right.

"FORWARD 16 INCHES" starts the motors attached to the wheels. It keeps them on long enough to move the robot ahead 16 inches.

"TURN ON GRINDER" starts a special cruncher so that a mining robot can break up ore in a mine.

Here is a program that would tell a robot arm holding a pen to draw a letter on the wall. Can you tell what the letter is?

MOVE ARM UP 10 INCHES
MOVE ARM RIGHT 3 INCHES
MOVE ARM DOWN 4 INCHES
MOVE ARM LEFT 3 INCHES

Cady Goldfield

Win a Treehouse T-shirt!

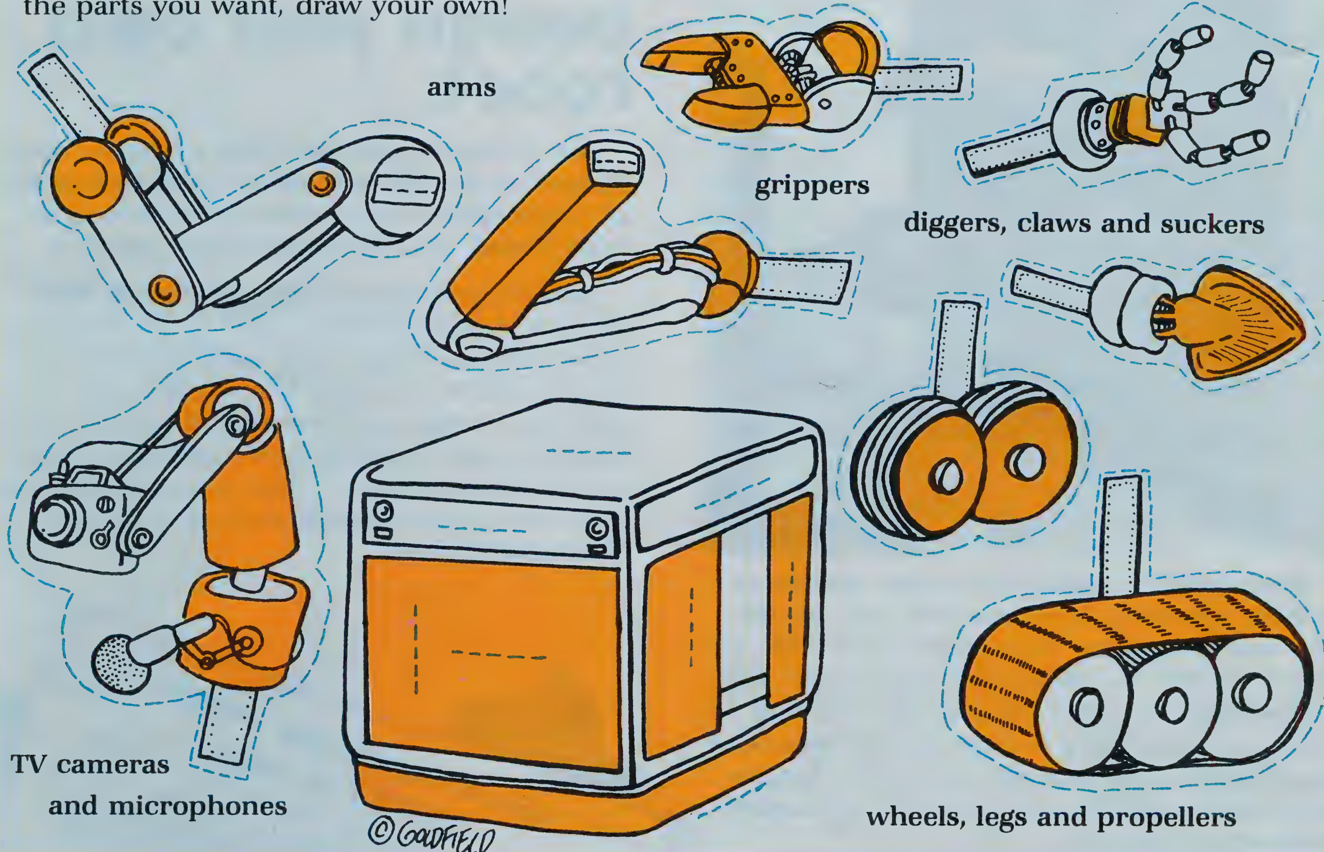
Invent your own computer language for a robot. List all the words that tell the robot what to do. Next to each word, note what the word means. Then write a program for a robot to do something. Fill in the entry blank on the last page. Send it to *Treehouse* along with your program. If we think your program's the best of any in your grade, we'll send you a *Treehouse* T-shirt. We'll also publish your name in *Treehouse.*

Making robots smarter

Will robots ever be as clever as the robots of science fiction? Scientists aren't sure. They have to solve lots of problems first. Many of these are mechanical. What shape should a robot have? Snake or submarine? Human or fly? Just an arm with several eyes? Or an eye with many arms? Should batteries, solar cells or a herd of mice power the robot? Should it move on wheels, crawlers, sneakers or treads? How gentle a touch should it have? Or how powerful a crunch?

A robot's looks depend upon the job it will do and where it will work. A factory robot will look different from one exploring the sea or outer space.

Below are some parts that might be hooked to a robot. Think of some work for a robot—maybe mining the ocean floor or repairing parts on a spaceship. Use the parts here to put together your own robot to do the job. Cut along the dotted lines, and slip the tabs of the parts into the slots on the robot. Explain why you chose the parts you did. If you can't find the parts you want, draw your own!



Cady Goldfield

Mechanical problems are fairly easy for scientists to solve. The problem of getting a robot to sense where it is and to decide how to do its job is harder. Wouldn't you like to have a robot that would make your bed, hang up your clothes and vacuum your room? The problem is, scientists still don't know how to keep your robot from vacuuming the cat!

It's not that robots are dumb. It's just that we're so smart. For instance, hold a pencil in front of you. First hold it sideways. Now hold it straight up. Next hold it eraser first, with the point down. No matter how you look at it, you know it's still a pencil. But the robot's computer brain has a hard time figuring out that the three views of the pencil are just that: three views of one pencil. And sensing a pencil is relatively easy—imagine a baseball robot trying to sense a spitball!

Have a friend blindfold you. Have your friend hand you some objects and see if you can guess what each is. How can you tell which object is which? What do you feel, hear, taste or smell? What's going on in your brain? Have your friend hand you a group of objects—two of which are identical. How do you identify the objects that are the same? How can you program a robot to do the same thing?

Robots on the job

Despite the problems of building really intelligent robots, thousands of simple robots work today. They work in factories in the United States, Japan and Europe. They are doing jobs that humans used to do like welding, assembling and painting automobiles. When people do these jobs, they often get bored and make mistakes. Robots can work hour after hour without mistakes.

Here are pictures of some industrial robots. What jobs do you think they do?

Automatix Inc.

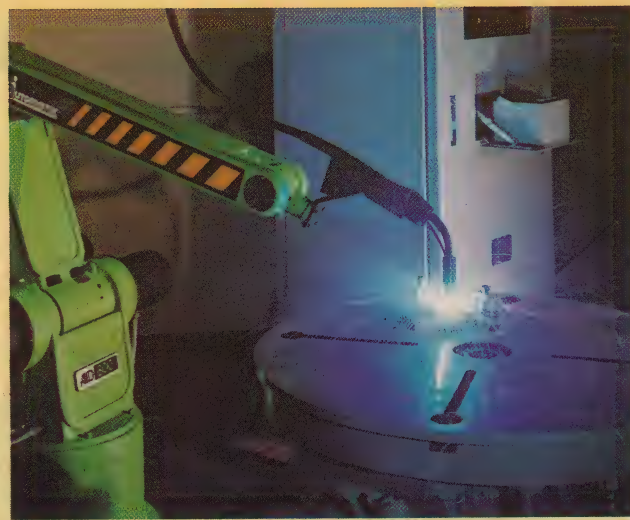
Some people wonder if it's right for robots to take jobs away from humans. How would you feel if someone came to you and said, "Go home. A robot is taking your paper route and babysitting jobs." But other people say that robots are necessary to improve our lives. And most people welcome robots that do dangerous jobs like dip metals into acids or handle radioactive materials.

Imagine that you are a congressman or -woman concerned about the good and bad uses of robots. Write some laws that would encourage positive uses of robots, but would protect people from harm. Make a list of jobs that you think robots should do and another of those they shouldn't. For example, how would you feel if you had to go to a robot dentist?

Treehouse Editor: Jeff Nilson
Robotics Consultant: Abby Gelles
Design: Ellen Whitman

Artwork on page 1: masthead, Coni Porter; illustrations, Lucasfilm Ltd., Dover's Wonderful Wizard of Oz Coloring Book, Cincinnati Milacron, © MCMLXXIX Walt Disney Productions.

For information on color reprints of *Treehouse*, write: *Treehouse* Reprints, *Classroom Computer News*, P.O. Box 266, Cambridge, MA 02138.



Automatix Inc.

Design your own robot

Just about anyone can build a simple robot. Some kids are doing it today. Todd Lofburrow of Connecticut built a robot while he was in high school. He even wrote a book about it.

Now it's your turn to design a robot. Think of a job that you'd like a robot to do. Design a robot that you think a kid could build to do the job. Fill in the entry blank below. Send it with your design to *Treehouse*. Be sure to include enough drawings and explanations for us to understand your ideas. If you design the best robot in your grade, we'll send you a *Treehouse* T-shirt.

HIDDEN LESSONS

by Gloria Stein

The lessons learned at a microcomputer keyboard can transcend those explicit in the program. Consider the following ideas for stretching the value of classroom computer time; they're sure to stimulate thoughts of your own.

Don't Judge a Program by its Title

That elementary school students know the capital cities of Europe is not a priority item. But this doesn't preclude using a program that teaches European capitals. Students *do* need dictionary skills, and they're often reluctant to practice them.

One microcomputer loaded with a program such as "Capitals of Europe" can accommodate at least six students, each armed with a dictionary. The children will hope for an unfamiliar country just to be first to look it up and correctly identify its capital.

Ask the children not to blurt out their answers. Acknowledge the student who finds the answer first, but allow time for the less skilled to thumb the dictionary pages. Once you've used the program, change the data. Your students will beg for more, and they *will* have memorized many of the capitals.

Locate the Learning Roadblock

While you don't need a computer to discover a student's deficiency in math, one might help you determine the deficiency's cause. Most computer users think out loud. A silent teacher working with a "thinking" student can learn quite a lot.

The youngster who blurts out quick, illogical responses could suffer from a common, most unfortunate problem: the immediate-answer syndrome. These students listen to their quicker peers year after year and conclude, "If I'm not quick, I'm dumb." The dumber they feel, the more difficulty they have learning.

True number reversals are also confirmed. The student mutters, "9x9 is 81," types in 18 and is satisfied. Or how about the child who doesn't understand numeric relationships—who rattles off multiples of five, but doesn't know 3x5?

Careful listening to thoughts will reveal individual roadblocks to learning.

Passive Resistance

Controlled, passive resistance is a common student weapon. Too often, students use it in response to parental pressure to do well. A microcomputer, with its consistent neutrality, could help break the pattern.

Only a rare child can resist the lure of a computer. Working alone, he/she will soon discover resistance doesn't pay off; the computer is far more passively resistant than the child. If the child refuses to respond, so will the computer—with *no* emotion. All the usual "rewards" from adults (frustration, anger, despair) are completely eliminated.

Computer, Television and Behavior

One microcomputer connected to a TV monitor for class presentations provides a powerful learning tool. The recognized value of students interacting with each other as they interact with the computer is further enhanced by the teacher's continual input.

Try this with classes that are difficult to manage. The computer-TV combination has a definite impact on behavior. The teacher, despite his or her contributions to the lesson, is not the center of attention, and students have little motivation to give the computer a hard time.

Give them the Silent Treatment

Silence is a teacher's most potent tool. The kids aren't used to it. A microcomputer allows for effective, silent teaching *without* a program. One computer accommodates as many as twelve children; when coupled with a TV monitor as described above, it serves an entire class.

Choose the stickiest current subject matter: use of complete sentences, perhaps. Silently type in your "lesson": "A COMPLETE SENTENCE MUST CONTAIN . . . ." Clear the screen and quiz. "BECAUSE IT IS RAINING TODAY." Follow with, "COMPLETE?" Call on students via the computer. "FRED." If Fred says, "incomplete," give him an electronic stroke: "GOOD FOR YOU!" Follow up with, "WHY?"

You might try variations on this theme. Ask students to give you a complete sentence beginning with the word "because," for example. Or ask them to identify the subject and predicate of a sentence you've displayed, or to identify parts of speech. Students' attention will be riveted on the computer. Teacher silence elicits total concentration on the written word. Learning results. □

Gloria Stein is a sixth-grade teacher in Ann Arbor, Michigan.

In Search of Administrative Software

by Kenneth Temkin

If you're a principal or an assistant principal, you know how much statistical data is required to run a school. A vast amount of administrative information must be gathered, recorded and disseminated for legal and other reasons. The principal's responsibility for maintaining such information is a burdensome but necessary chore.

Help has arrived, however, in the form of microcomputer software geared to school administration. Many good offerings available today may fit your purposes and make work easier. You can find the right programs if you are patient and deliberate in your selections.

Analyze the Situation

Before you begin looking for software, you need to answer some questions:

(1) What computer hardware do you have at your disposal?

(2) Who is around to work with the computer?

(3) What are your goals and priorities?

The computer hardware is very important. Usually the more sophisticated the software, the more complicated the necessary hardware. See the teacher in charge of computer courses to discuss what is available in your school. If you're lucky, you will already have a good computer system. Your in-house computer person can probably advise you of the need for any additional equipment. A fast 80- or 132-column printer, for example, could be a good investment. Take a list of existing equipment with you when you go scouting software.

Your second decision is, who will work with the computer? You might choose to train a secretary, to hire a computer operator or work study student with computer experience, or to do it yourself. Your choice (if you have one) could very well influence how complex a software package you buy.

Finally, make a list of administrative jobs you would like to see computerized. Include the data and time involved. Now, with your new knowledge of the equipment, people and needs, you are ready to talk software.

What's Out There

There are many avenues to finding good administrative software.

- Write to major textbook publishers. (Addison-Wesley and Scott, Foresman are two companies presently producing series of administrative software.)
- Read computer magazines. Many of them include program listings with their articles or valuable resource listings.
- Call your local computer store. The salesperson may know about or have a program to suit your needs.
- Write to computer hardware manufacturers. (Companies such as Apple offer software information as a service to their users. Radio Shack goes a step further and sells business software.)
- Speak to other school systems. They may already have researched the market and can save you time and energy.
- Ask major software dealers if they have anything relating to school administration. (Personal Software, for example, distributes *VisiCalc,* which has applications including budgeting, teacher records, master scheduling, sports records, simple inventory, etc. See "An Administrator Looks at *VisiCalc," Classroom Computer News,* Vol. 1, No. 2.)
- Enlist the aid of local computer societies. An educational users' group is often affiliated with such organizations.
- Attend computer shows. There is no better place to find many sources under one roof. Dealers are there to demonstrate and explain their offerings to you.
- Spread the word about what you are looking for at meetings of your professional associations and cooperatives. If other members are interested, perhaps a software research committee could be formed.

Administration

• Read trade magazines in your field. Return business reply cards if something looks interesting.

• Scan mail-order catalogs and flyers. The program you are looking for may be offered as one of the educational or business selections.

The Selection Process

After seeking out and discovering interesting programs, you are faced with deciding what to buy. The catalog or salesperson may promise you the world, but take your time and be selective. Here are some suggestions:

• Do not buy blind unless you can afford to throw money away. If possible, ask to see all parts of the program in operation. Sales representatives and computer stores will usually be happy to oblige. A free trial period may even be in the offing.

• Find out if the seller is willing to stand behind the program with a money back guarantee if you are not completely satisfied.

• Get names of schools that have bought the program. Try to get your hands on the particular software prior to purchasing it, maybe through another school.

• You can learn a lot by simply reading the manual from beginning to end. If the manual is written well, you can acquire a good understanding of the program without going to the computer. You should also be able to judge the technical level of the software and see how compatible the program is with your present manual system.

• Get some sample printouts to see what information the program reports and how. Is it understandable? Do the information and the format meet your requirements for budget and accounting, student records, inventory, etc.?

• Make sure the software is compatible with your existing hardware or be prepared to purchase the necessary equipment. The minimum hardware requirements are usually specified on the software package.

• Weigh the potential labor savings against the cost of the program(s). Perhaps the programs do not justify new equipment expenditures.

• Find out if the publisher has a telephone service for program maintenance (questions, problems, errors, etc.). This could prove invaluable if you are stuck in the middle of a program.

• Start with simple, proven programs that are sure to help you immediately—a mailing list system, for example.

After the Purchase

After you have your new computer program in operation, run it simultaneously with your old system. Do this until you are convinced that the program is either a hit or a miss. If the program turns out to offer less than promised, write and complain. And don't ever be too content; always keep a keen eye open for something better. □

Kenneth Temkin is the administrative assistant for support services for the Newton Public Schools, Newton, Mass.

Media

Organizing a Software Collection

by Lucia Skoman

Now that the microcomputer has become part of your reality, do you have a jumble of software in boxes drawers? Do you have trouble finding *Lemonade* or *Westward Ho?* Is *Hurkle* or *Bagels* eluding your searches? If so, consider this plan for organization.

At our regional educational media center in Ann Arbor, Michigan, we have a computer program that helps us organize other materials. It uses a seven-digit number for access, and it generates a catalog containing a section of annotations arranged alphabetically by title and another section organized by subject. We've successfully adapted this system for organizing our microcomputer software.

We apply the seven-digit number in the following way: the number 05-001-40 has three components. The "05" is a code for cassettes, the "001" is the sequential shelf number and the "40" is a code for the PET microcomputer. In the number 10-001-50, the "10" is a code for disks, the "001" is the sequential shelf arrangement number and "50" is a code for the Apple II.

We distinguish between cassettes and disks in the first two digits because we store the 05's, or cassettes, in a metal cassette cabinet and the 10's, disks, in notebooks with vinyl looseleaf protectors.

A disk for a TRS-80 would have the number 10-001-60, with the 10 indicating a disk and the "60," a TRS-80. A cassette for an Apple II could have the number 05-002-50, with the "05" indicating a cassette and the "50" the Apple II.

The annotated section of the catalog will contain the title of the cassette or disk, followed by the type of computer, the accession number, the software producer, the grade level code,* a brief description of the material with further grade-level distinction if necessary, and a listing of all the subject headings under which the material may be found. The type of computer follows the title of the software so that we can easily retrieve material under curricular subject headings by type of computer. A typical annotation follows:

HOMONYM MACHINE, PET	05-005-40
Micro-Ed	P, I

Word is flashed on the screen, student chooses its homonym. The answer is fed into the homonym machine, which determines whether or not the answer is correct. Words such as "peace," "pain" and "way" are used. *Homonyms, language arts, PET*

The second part of the catalog, which is organized by subject heading, allows us to retrieve material by type of computer. All programs for the Apple II are listed under the subject heading "Apple II." All materials for the PET or TRS-80

Media

will be listed under these subject headings as illustrated below:

PET		
Treble Clef, PET	05-003-40	I J
Spanish Vocabulary, PET	05-004-40	I J
Homonym Machine, PET	05-005-40	I J
APPLE II		
Music Box, Apple II	05-007-50	I J
Homonyms, Apple II	10-001-50	P I
Word Search, Spanish, Apple II	05-009-50	J
TRS-80		
Word Search, Spanish, TRS-80	05-010-60	J
Homonyms, TRS-80	10-004-60	P I

The next illustration shows that we can retrieve the materials by curricular subject headings and under those headings by type of microcomputer, as well.

HOMONYMS		
Homonyms, Apple II	10-001-50	P I
Homonym Machine, PET	05-005-40	P I
Homonyms, TRS-80	10-004-60	P I
MUSIC		
Music Box, Apple II	05-007-50	I J
Treble Clef, PET	05-003-40	I J
SPANISH LANGUAGE		
Spanish Vocabulary, PET	05-004-40	I J
Word Search, Spanish, Apple II	05-009-50	J
Word Search, Spanish, TRS-80	05-010-60	J

To process the cassette tapes we use pressure sensitive cassette labels, one for the front and one for the top of the tape as illustrated:

05-005-40
Homonym Machine, PET

Language Arts, Homonyms

05-005-40 Homonym Machine

We use a smaller label on the vinyl protector pocket in the notebook for the disks, and one label each on the disk and on its paper envelope.

We have prepared envelopes with an attached card and pocket for checking out cassettes. "Microcomputer Cassette" appears across the top of the charge card, along with a number of blanks for the accession numbers and a space for the user's signature. The cards can be reused. To check out the disks we use notebooks with looseleaf vinyl protectors with a card and pocket attached.

These techniques have worked beautifully for our district media center and have brought order out of chaos. Perhaps some of them will help you. □

* P, primary; I, Grades 4, 5, 6; J, Grades 7, 8, 9; S, Senior High.

Lucia Skoman is a librarian for Regional Educational Media Center No. 16, Ann Arbor, Michigan.

Reviews

Books

Educational Software Directory, Apple II Edition. Sterling Swift Publishing Co., P.O. Box 188, Manchaca, TX 78652, 1981. 103pp; index.

A short time ago, many teachers didn't know the difference between a microcomputer chip and a potato chip; today, they're using microcomputers in every phase of school life—from writing individual multiple-choice tests to administering system-wide programs. Given a taste of classroom computers, they want more—and more means more software.

Although a few technology-wise teachers are experimenting with their own programs, most must rely on commercial software. The trouble is, quality software is not easy to find. There are two problems: few sources of software evaluation exist, and the industry lacks the standardization that would make programs written for one microcomputer compatible with another.

While the ultimate solution to these problems may be a little further down the road, Sterling Swift's *Educational Software Directory* is a sorely needed boost along the way. This well-organized and well-designed guide features 58 commercial and seven noncommercial manufacturers of software for the Apple II.

Entries are arranged alphabetically by manufacturer with addresses and, usually, telephone numbers. Full annotations for each program or package include: title, price, grade levels, memory requirement and description. A very helpful index divides titles into elementary, middle and high school, college-level, administrative and courseware categories.

Among the manufacturers listed we find such heavy hitters as Milliken, Science Research Associates and Bell & Howell alongside smaller vendors such as Micro Power and Light Company, Softape and Cook's Computer Company. The types of programs listed include "Computer Literacy or Awareness," "Computer Assisted Instruction," "Administrative" and "Statistical Packages." Side dishes such as games and simulations were omitted, with apologies, unless a "clear educational basis" could be discovered in them.

In the introduction, the editors explain the use of two symbols which appear throughout the book. The first indicates "school publishers," such as Milliken and Borg Warner Educational Systems, whose packages are "specially designed for classroom use"; the second indicates a "particularly important lesson or package . . . [containing] material that is very highly regarded." Undoubtedly, these are two very useful pointers in a directory of educational products. The introduction ends, however, with an inauspicious disclaimer that states: "All program descriptions are based on either having seen the programs or on material supplied by the program's publisher or from ads or announcements by the program's publisher." Unfortunately, we are left guessing which programs were actually seen and judged a "particularly important lesson," and which were merely assumed to be important, valuable or very highly regarded on the basis of promotional materials.

Misleading symbols notwithstanding, the *Educational Software Directory* does an admirable job of gathering material from diffuse sources and presenting it effectively. **—Jeffrey Katz**

Jeffrey Katz is assistant director of the Reading Public Library, Reading, Mass.

Software

READING COMPREHENSION
Produced by: Instructional Communications Technology, Inc., 10 Stepar Place, Huntington Station, NY 11746

Available for Apple II only

Cost: Four diskettes; $150 each

This program offers students practice in reading comprehension at different speeds. The student can choose to have the text displayed at a preset speed or can advance each line manually.

When the program begins, the student can preview the reading selection, viewing sections of the story designed to enhance recall and recog-

Reviews

nition. The student then selects the rate at which the lines will be presented and begins. The program presents one line of the story at a time, reinforcing linear, left-to-right reading (some teachers may consider this a problem). The usual comprehension questions, two or three at a time, follow each part of a selection. Students can opt to reread the entire passage preceding a question they can't answer. The question will be presented again. Correct responses bring a "Correct" from the computer; incorrect ones, "Wrong—try again." After a second wrong answer, the program provides the correct response and erases the other choices, leaving only the question and the correct response on the screen.

The program provides a good summary of student performance at the end of each reading selection. It scores performance in each subskill area (inference, factual recall, etc.), as well as overall percent correct, speed and corrected speed. Scores can be printed out on paper.

This program is well written and well done. One problem is that the student cannot exit the program or press a key that will stop it; a "quit" option would be nice for long lessons in short periods. Nonetheless, if you need computerized reading drill, you will want to look at this program.

MILLIKEN MATH SEQUENCES

Produced by: Milliken Publishing Company, 1100 Research Blvd., St. Louis, MO 63132

Apple II version: Grades 1-8; teacher management system
Commodore PET and TRS-80 Level II versions: Grades 1-6; no management

Cost: Apple II: 12 diskettes for $450
PET and TRS-80: 12 diskettes for $200

Milliken's *Math Sequences* offers drill and practice in math skills ranging from addition through decimals and percents for elementary school and junior high students. Both versions (with and without the Manager Program) include a Teacher's Guide that clearly illustrates the skills students will be practicing.

The program divides each skill area into "problem levels." The problem levels are small, sequential steps that increase in difficulty so that students can begin at levels that challenge their abilities. The multiplication unit, for example, offers 62 problem levels. The computer monitors students' performance, advancing them or moving them down a level as necessary.

The management system for the Apple II version is flexible and easy to use. The Teacher's Guide provides clear, detailed instructions on setting up the management system. I needed just five minutes using the book to set up a sample class.

The management program lets teachers prepare either individual or class assignments. Teachers can assign students to skip levels or can stipulate the order in which levels are done. They can set the percent levels for advancement or for demotion to the preceding assigned level, can specify the minimum number of problems in each level and can choose the appropriate reward for correct responses (both animated graphics and textual messages such as "correct" are available). Teachers can also obtain printed student progress reports that include graphs that quickly identify students' strengths and weaknesses.

At the moment, if you own a PET or a TRS-80 without a disk drive, the Milliken *Math Sequences* is the only comprehensive math drill package available. If you have a TRS-80 with a disk drive, or an Apple II, take a look at Science Research Associates' math package as well. Both the Milliken and the SRA packages have their advantages and partisans.

All in all, the Milliken series is well done, user-proof and easy to use. If you want or need a sequential drill-and-practice program in mathematics for elementary or junior high, or a remedial program for junior or senior high, consider the Milliken *Math Sequences*. **—Glenn Fisher**

Glenn Fisher is school computer specialist for the Alameda County Office of Education, Hayward, California.

Cont. from page 15

535 REM *** The user should have a working familiarity with how BASIC is and can be used to teach the computer. The most common BASIC commands should be illustrated, and the user should have a chance to try to write a small program to solve a simple problem (the problem might come from lines 200-299, above).
540 MODIFY BASIC
545 REM *** The user should be shown how many BASIC programs can be modified in part to better suit the user's needs. The emphasis is on giving the user a sense of control over some portions of the world of programs (see the program *Buzzword* by Beagle Bros.).
590 GOSUB 1000
595 GOSUB 2000
597 GOSUB 3000
599 RETURN
600 PRINT "THE MANY FACES OF COMPUTER SOFTWARE"

The computer is an honest and patient mirror of our own mind. If teachers can begin to appreciate and learn from the reflections they see in it, they may begin to know the power this technology gives to education.

630 USE *Music Tutor* (MECC or Creative Computing Software) or USE other suitable program
635 REM *** Numerous programs do a reasonable job of using the computer to teach someone something (tutorial programs). The user should have a chance to think about the characteristics of effective and ineffective tutorials both from the point of view of pedagogy and of program quality.
640 USE *Textrain* (Beagle Bros.) or USE other suitable program
645 REM *** Games can provide opportunities for learning, and this particular game might help users to plan sequences of activities. Users should have opportunities to explore the educational use of a variety of computer games.
650 USE *Lemonade* (Apple Computer Products) or USE *Odell Lake* (MECC or Creative Computing Software) or USE *Flight Simulator* (Sublogic) or USE other suitable program
655 REM *** The computer can be used very effectively to create different types of simulations for users to participate in and to study. The user should have an opportunity to sample a number of different types of simulations.
690 GOSUB 1000
695 GOSUB 2000
697 GOSUB 3000
699 RETURN
1000 LEARN Fundamental Concepts
1010 REM *** A host of concepts and ideas related to understanding and using the computer should be taken up as needed in the process of this teaching procedure. (The reader is referred to "When the Teachers Ask," by Beth Lowd, on page 8).
1020 RETURN
2000 LEARN Resources
2010 REM *** There are many resources, both material and human, that the user should be informed about as needed in the course of this teaching procedure. (The reader is referred to the July/August issue of *CCN, The First Annual Compendium of Common and Uncommon Computer Lore.*)
2020 RETURN
3000 APPLY Concepts
3010 REM *** Users should discuss and attempt to develop applications of concepts learned both within the curriculum as defined by their school district and, one hopes, beyond.
3020 RETURN ☐

Henry F. Olds is coordinator of microcomputer advisory services for Intentional Educations, Inc., publishers of this magazine.

PET SHOPPE

Cont. from page 17

came previous limitations and biases.

Once our learners became comfortable with the basics of operating a microcomputer, we led them into the pedagogical morass of instructional program quality issues. In an electronic version of "If it's in print it must be true," new users are easily seduced by the captivating powers displayed by the nimble computer. It seems almost a developmental necessity that the same teacher who came full of doubt only yesterday will quickly decide that each program previewed is even more captivating than the one just concluded. Now is the "teachable moment," the time to intervene with the pedagogically poorest program within reach and to start asking hard questions. Teachers who feel competent to analyze text books and related *print* materials can apply the same critical eye to the computer's particular abilities, but the technological wizardry—the bells-and-whistles aspect of computers—often gets in the way.

We have accumulated a relatively large program library by copying all public domain programs possible and by purchasing commercially developed programs that "sounded good." We cherish the pedagogically lousy programs, along with those of better quality, for three reasons. They serve as excellent foils to good examples of instructional programming. I remember being frustrated in an art appreciation course when the instructor showed examples of great paintings only. Since I had nothing with which to contrast these "great" representative artworks, I had to accept the judgment on faith.

Secondly, I believe poorly done programs are a key to motivating computer learners to program for themselves or at least to improve upon the poor example. In the world of computing it is happily possible to act upon the old law, "Even I could do better than that . . . ." And finally, we keep poor instructional programs around to gauge progress in the field. It is very encouraging to compare work from three to five years back with recent examples.

Our work to date has produced several lessons worth careful note and observance.

(1) Although it appears inefficient, no substitute exists for individual instruction with massive doses of hands-on. The anemic short-run body count figures are eventually overcome by the geometric progression implied in the collegial "each one teach one."

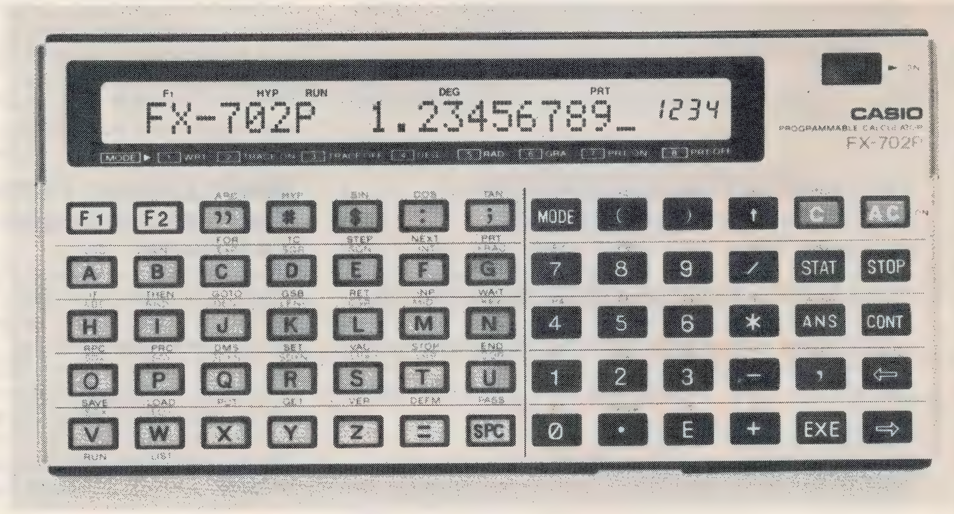
(2) Programmers come in unexpected forms and from unlikely places. By "programmers" I mean that subset of humans who take quickly and seriously to the fine points of computing, machine code and all. Two of my biggest surprises to date are a library aide (at least for now) and a parent whose official occupation is a train oiler at the Southern Pacific railroad yard.

(3) Listen diagnostically to the keystroke sound made by the computer learner! If the person fairly stabs the keys (and especially the RETURN key) you can bet he or she is particularly threatened or intimidated by the computer. This one needs special attention.

(4) The cultural baggage many adults bring when they first face a computer is very powerful and inhibiting. It is very telling when a learner plays the *Animals* program and *whispers* to me a choice as the computer asks, "Please think of an animal and I will try to guess it." □

Jack Turner is director of The Bethel-Eugene-Springfield Teacher Center in Eugene, Oregon.

New Products



Casio, Inc., a manufacturer of electronic calculators, has introduced a new handheld computer with a memory capacity of 1,680 program steps involving up to 26 variables. Users can expand its programming capacity by adding a ROM package (extra Read Only Memory). The Casio FX-702P uses BASIC as its language. It can hook up to a printer and can transfer programs directly to any cassette tape recorder. The FX-702P is available from some Casio dealers. For further information, contact Casio, Inc., 15 Gardner Rd., Fairfield, NJ 07006; 201/575-7400.

Product briefs are written from manufacturers' announcements.

Teacher/ Administrator Management Tools

MicroPlanner provides comprehensive management tools for both teachers and administrators. It includes a Curriculum Management System (CMS), Teacher Planning System (TPS) and an Administrative Planning System (APS) with appropriate documentation.

The Curriculum Management System (CMS) allows teachers to create computer-based curriculum with user-defined categories and to update the curriculum with an easy-to-use word processing system.

The Teacher Planning System (TPS) gives teachers the power to create and modify student records according to their needs, to develop IEP's or progress reports using the CMS database and to edit and print student reports.

The Administrative Planning System (APS), which incorporates the CMS and TPS systems, lets the administrator create administrative student records as well as audit program effectiveness and print administrative reports.

MicroPlanner is available on single density five- or eight-inch disks for most popular microcomputers.

For further information, contact Learning Tools Inc., 4 Washburn Place, Brookline, MA 02146; 617/566-7585.

Microsoft BASIC for Atari

Microsoft BASIC is now available for the Atari 800 computer.

The language is faster than Atari BASIC and provides greater floating point precision. The new language makes many games and programs already on the market available to Atari owners.

It requires either an Atari disk drive or program recorder and 32K RAM. *Atari Microsoft BASIC* is available from any Atari dealer.

For further information, contact Atari Inc., 1265 Borregas Ave., P.O. Box 427, Sunnyvale, CA 94086; 408/745-5069.

Software at a Discount

Buying in large volume? Creative Discount Software of California offers its customers discounts on orders of $50.00 or more.

Creative Discount Software stocks products from Charles Mann & Associates, Edusoft, Games Enterprises, Monument Computer Service, Muse, Personal Software, CompuSolo and Personal ComputerSoft. All products are directly supported by the manufacturers.

Discounts are figured before California sales tax,

New Products

shipping charges or C.O.D. charges. All sales are final. Discounts range from five percent on orders less than $100.00 to 30 percent for orders of over $750.00.

For a product listing, call Creative Discount Software, 256 S. Robertson, Suite 2156, Beverly Hills, CA 90211; California: 800/852-7777; Hawaii/Alaska: 800/824-7919; all others call: 800/824-7888.

Attendance Reporting System

The *Attendance Reporting System* produced by Educational Services Management Corporation produces absentee and tardiness reports for a school of any size. It allows the user to define eight absence categories. Summary reports may be for any date range and may be organized by student name or date.

The system can be used by the clerical staff of the school and requires no previous computer experience. It is a completely self-contained system.

The system requires the Apple II with 64K, two 5-inch disk drives and a printer. For additional information contact Educational Services Management Corporation, Dept. M, P.O. Box 12599, Research Triangle Park, NC 27709; 919/781-1500.

Computer Serves up to Eight Students

The Dolphin® classroom computer is now available from TSC, Houghton Mifflin's electronic publishing subsidiary. This compact microcomputer offers the storage and data-handling capacity of a larger system, but does not require a special operating environment, trained personnel or expensive phone line hookups; the unit resides in the classroom itself and is operated via a single on/off switch.

Using hard disk information storage techniques, the Dolphin allows up to eight students to work simultaneously on TSC/Houghton Mifflin's math, language arts or reading programs. Students sit at individual keyboard/CRT terminals and interact with the programs at their own pace.

For additional information, contact TSC, Dept. 33, Hanover, NH 30755; 603/448-3838.

Reading/Math

Edu-Ware Services, Inc., has released its *Compu-Read 3.0* and *Compu-Math Fractions* in Atari BASIC. Both were previously available only in Applesoft.

Compu-Read 3.0 aims at building the student's skills by strengthening the perceptual processes necessary for reading. *Compu-Math Fractions* builds math skills by presenting a series of concepts and exercises to reinforce correct performance.

Both require 48K Apple or Atari systems.

These initial releases are the first step in Edu-Ware's expansion of its product line to include the Atari 800, Commodore PET and TRS-80 microcomputers.

For further information, contact Edu-Ware Services, Inc., 22222 Sherman Way, Suite 203, Canoga Park, CA 91303.

Calendar

September

Information Processing Administrators of Large School Systems (IPALSS). September 24-25. Imperial Palace, Las Vegas, Nevada. IPALSS annual fall meeting. Contact: Ron Jones, Clark County School District, 2832 E. Flamingo Rd., Las Vegas, NV 89121; 702/736-5405.

Humanizng and Utilizing Communications Technology. September 28-30. McKimmon Center, Raleigh, North Carolina. Will explore the use of communication technology in education. Sponsored by the North Carolina Adult Education Association. Contact: Phyllis Johnson, P.O. Box 2019, Raleigh, NC 27602; 919/821-1435.

October

Classroom Applications of Computers. October 2-3. Independence High School, San Jose, California. Steve Jobs, cofounder of Apple Computer Inc., will be keynote speaker. Contact: W. Don McKell, Computer-Using Educators, Independence High School, 1776 Educational Park Drive, San Jose, CA 95133; 408/288-7642.

Microcomputers in Education. October 2-4. University of Maryland, University College Adult Education Center, College Park, Maryland. Eight workshops on educational uses of computers and programming. Contact: Sharon Woodruff, Technical Education Research Centers, 8 Eliot St., Cambridge, MA 02138; 617/547-3890.

ACM SIGSMALL Symposium on the Impact of Small Computer Systems. October 12-13. Orlando, Florida. Sponsored by the SIGSMALL special interest group of the Association for Computing Machinery. Contact: Ron S. Oliver, The Mitre Corp., 433 N. Circle Drive, Colorado Springs, CO 80909; 303/471-0212.

Educational Computer Fair. October 17. Cuyahoga Community College, Cleveland, Ohio. Over 20 workshops including hands-on sessions. Contact: Ellen Richman, 245 Meadowood Lane, Moreland Hills, OH 44022; 216/292-4655.

Calendar

NYSAEDS Annual Conference. October 18-20. Syracuse, New York. The New York State Association for Educational Data Systems conference will focus on software. Contact: Don Ross, Ardsley High School, Ardsley, NY 10502.

Workshop on Microprocessors and Education. October 20-21. Colorado State University, Fort Collins, Colorado. Sponsored by IEEE. Contact: T. A. Brubaker, Dept. of Electrical Engineering, Colorado State University, Fort Collins, CO 80523; 303/491-5028.

Information Technology on Campus: Critical Discussions for College and University Officers. October 20-21. Hilton Plaza Hotel, Kansas City, Missouri. EDUCOM 17th annual conference co-sponsored with the American Council on Education. Contact: Carolyn Landis, EDUCOM, P.O. Box 364, Princeton, NJ 08540; 609/734-1915.

Microcomputers in Education. October 22-24. Ontario Science Center, 770 Don Mills Rd., Toronto, Ontario, Canada. See listing above.

National Association of Biology Teachers National Convention. October 22-25. Sahara Hotel, Las Vegas, Nevada. Five presentations on using computers to teach science. Contact: Sue Nolan, NABT, 11250 Roger Bacon Drive, Reston, VA 22090; 703/471-1134.

Computers, Productivity and Special Education Administration. October 23. Washington, D.C. Conference aims to provide an understanding of what computers can do for special education. Contact: Gary Snodgrass, National Association of State Directors of Special Education, 1201 16th St., N.W., Suite 160E, Washington, D.C. 20036; 202/833-4218.

November

Administrative Computing Packages. November 5-6. Minneapolis, Minnesota. Demonstration and documentation on both large and microcomputers. AEDS workshop. Contact: AEDS Workshops, 1201 16th St. N.W., Washington, D.C. 20036.

Calendar

Association for Computing Machinery (ACM) Annual Convention. November 9-11. Hotel Bonaventure, Los Angeles, California. Several sessions on educational computing. Contact: Louis Fiora, ACM, 1133 Avenue of the Americas, New York, NY 10036; 212/265-6300.

The Minneapolis/St. Paul Meeting of the National Council of Teachers of Mathematics. November 12-14. St. Paul Radison, Minneapolis, Minnesota. Forty-two computer sessions coordinated by the staff of MECC. Contact: Sally Sloan, 807 Broadway, N.E., Minneapolis, MN 55413.

Microcomputers in Education. November 22-24. Harvard University, Cambridge, Massachusetts. See October listing.

Reprints & Previews

Sorting and Shuffling is a 20-page booklet of reprints from *Creative Computing*. It includes in-depth discussions of five sorting techniques (bubble, heapsort, Shell-Metzner, delayed replacement and Woodrum). It also covers file structures and shuffling techniques. Most textbooks either ignore or gloss over these techniques. The booklet is a vital necessity for those doing any programming at all. 50 cents.

Guide to Computer Music Systems by Phil Tubb primarily dicusses the design philosophy behind the ALF computer music system. It also covers the principles of computer music reproduction and compares three popular systems for the Apple II. $2.00.

Stocks and Listed Options by Alfred Adler is a collection of five articles about using a small computer for analysis of a stock portfolio with an emphasis on listed options. The booklet serves as the instruction manual for a 5-program package for the TRS-80 marketing by Creative Computing Software. $1.00.

Odell Woods. This is a program listing in Basic and instruction booklet for a popular MECC program. In it, the user plays the role of a fox, mouse or wolf and attempts to survive in the northwoods. The listing is in Applesoft Basic but uses few special features so it could be converted easily to other systems. $1.00.

FREE 48-Page Catalog

A new, free 48-page catalog is free from Creative Computing and Peripherals Plus. To help buyers make intelligent purchasing decisions, the product descriptions are exceptionally comprehensive and include screen photos in the software section.

The catalog describes 20 books on programming, games, and educational applications; 160 software packages for Apple, Atari, TRS-80, PET, CP/M, TI, Sorcerer and Sol computers; 3 magazines (*Creative Computing*, *Microsystems*, and *SYNC*); 5 graphics and music peripherals; an LP record; board game; 8 T-shirts and an eclectic assortment of other products for the personal computer user.

To get your free copy, simply drop a card or note to the address below.

creative computing

39 East Hanover Avenue
Morris Plains, NJ 07950

Special editions for Apple, Atari and TRS-80 Computers.

Hey kids, are the folks out of the room? Good, 'cause I've got a secret to tell you. You know that computer they fuss over? Well, kid, between you and me, this whole programming thing is a lot simpler than they realize.

What's that? Sure, you can learn. Just get a copy of **Computers For Kids**. It's a super book, and it tells you everything you need to know. Huh? You have an Apple? No problem. There's a version just for the Apple. One for the TRS-80 and one for the Atari too, with complete instructions for operating and programming.

The book will take you through everything programmers learn. Its easy to understand and the large type makes it easy to read. You'll find out how to put together a flowchart, and how to get your computer to do what you want it to do. There's a lot to learn, but **Computers For Kids** has 12 chapters full of information. You'll even learn how to write your own games and draw pictures that move.

Just so the folks and your teachers won't feel left out, there's a special section for them. It gives detailed lesson ideas and tells them how to fix a lot of the small problems that might pop up. Hey, this book is just right for you. But you don't have to take my word on that. Just listen to what these top educators have to say about it:

Donald T. Piele, Professor of Mathematics at the University of Wisconsin-Parkside says, "**Computers For Kids** is the best material available for introducing students to their new computer. It is a perfect tool for teachers who are learning about computers and programming *with* their students. Highly recommended."

Robert Taylor, Director of the Program in Computing and Education at Teachers College, Columbia University states, "it's a good idea to have a book *for chidren*."

Not bad, huh? Okay, you can let the adults back in the room. Don't forget to tell them **Computers For Kids** by Sally Greenwood Larsen cost only $3.95. And tell them you might share it with them, if they're good. Specify edition on your order: TRS-80 (12H); Apple (12G); Atari (12J).

Your local computer shop should carry **Computers For Kids**. If they don't ask them to get it or order by mail. Send $3.95 payment plus $1.00 shipping and handling to Creative Computing Press, P.O. Box 789-M, Morristown, NJ 07960. Attn: Candy

creative computing press

Letters

A Catchy Fish

I read Ricky Carter's article "To Catch a Mathematical Fish" (Volume 1, Number 4) and sat down immediately to key in this Applesoft program. I can sum up my impression in just three words: I love it!

I did find one major problem in using the program, though. If you opt to play again without restarting or changing the size of the ocean, the fish stays in the same position. An inspection of the listed program revealed the bug. Variable F (fish position) remained constant until the game was restarted or until the ocean size was changed. This bug can be easily exterminated by changing line 1490 to read:

```
1490 IF Z = 1 THEN HOME : GOTO
     161
```

So impressed was I with the program that I began sprucing it up to make its appearance more attractive to children. I think a change in line 1420 is a must:

```
1420 HTAB (4 * Q): PRINT "<";:
     FLASH: PRINT "FISH";:
     NORMAL: PRINT "<"
```

These alterations will give the fish a tail and cause its middle to flash on and off. This gives a little emphasis to and visual reward for a correct answer and also adds a bit of excitement for the little ones.

As a member of the Computer Use Feasibility Committee for the City of Poughkeepsie Public Schools, I have been reviewing a great deal of educational software. I have found few examples which function so well with such wonderful simplicity. My hat is off to Ricky.

Michael Falina
Poughkeepsie, New York

An Issue Hard to Top

I have been very pleased and impressed with all of the issues of *CCN*, but the May-June 1981 issue will be hard to top. After reading it from cover to cover, I wrote two letters asking for further information; made a telephone call to share some information; and brought three different articles to the attention of six colleagues. That issue alone was worth the price of a year's subscription!

Thank you, and keep up the good work.

Steve Barnard, Principal
Huntington Woods Elementary School
Wyoming, Michigan

Setting the Record Straight

I appreciated Dan Isaacson's article, "What's Holding Back Computer Use in Education?" Volume 2, Number 5), especially his willingness to tackle the numbers inherent in courseware development. While I would raise some numbers and lower others, his conclusions seem right to me, except for the implication that anything important and worthwhile will probably be done by the government or with its grants.

The surely well-informed statement that no one has been working full-time on micro courseware is puzzling to us, since our small firm has had five to 10 full-time programmers working continuously for the past five years, and in this period have produced 1024 "chapter-length" programs arranged in 64 "courses." While we were by contract between 1977 and 1981 prohibited by Atari, Inc., from announcing or selling programs in our system, which they call "Talk and Teach," Atari itself in late 1978 announced 16 of our courses, composed of 256 chapter-length programs.

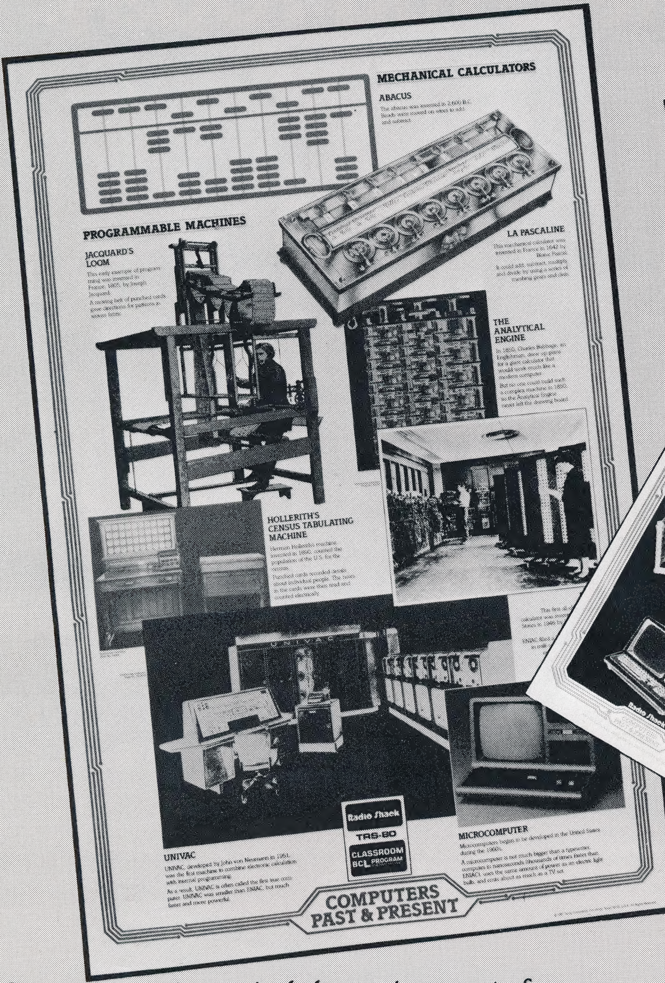
Loyd G. Dorsett, President
Dorsett Educational Systems, Inc.
Norman, Oklahoma

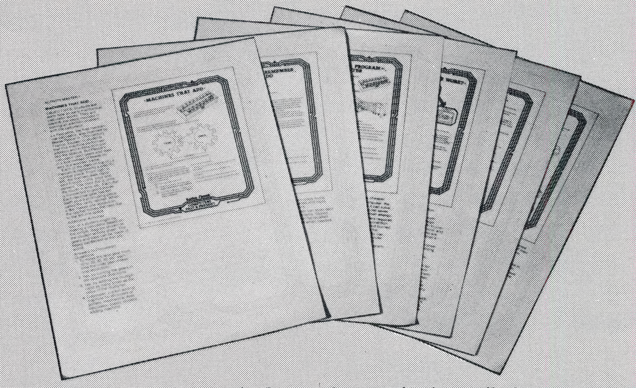
Corrections

- The address for Educational Courseware was incorrectly reported in the July/August issue of *Classroom Computer News*. The correct address is: 3 Nappa Lane, Westport, CT 06880.
- The software directory published by SoftSide Publications, 6 South St., P.O. Box 68, Milford, NH 03055, is called *SoftSide*, not *Appleseed*.

Index of Advertisers

Let Radio Shack Introduce Your Class to Computers For Only $9.95!





Computers are increasingly becoming a part of everyone's life — from the supermarket checkout counter to airline reservations to personal and educational uses. So it pays for students to have a solid understanding of computers, their history, and their applications in our world today. Now they can with Radio Shack's new TRS-80 Basic Computer Literacy Classroom Package.

Radio Shack Knows You're an Educator — Not a Computer Expert

We developed the TRS-80 Basic Computer Literacy Package for the classroom teacher. It's an excellent overview of computers — past and present — for grades 4 through 8, and it includes all the materials needed. Don't worry if your knowledge of computers is limited — the teacher's guide directs you each step of the way. And best of all, you don't need a computer! All of the activity objectives can be accomplished without any "hands on" experience. And the complete TRS-80 BCL unit can be used by itself or supplemented with other resources.

Radio Shack's TRS-80 Basic Computer Literacy Package includes a teacher's guide, a wall chart, and six spirit masters for duplicating student activity sheets. In the comprehensive teacher's guide you'll find a background survey of computers with a bibliography for further reading. Objectives are precisely stated, and there are suggestions for class projects and extra-credit work. The activity sheets illustrate the history of computers, what a computer is, what it can do, and how it works. Also, a short sample computer program is shown and analyzed. The colorful 22 x 34" wall chart illustrates the history of the computer — from the abacus to the modern TRS-80.

Get Your New TRS-80 BCL Package Today!

It's available from your nearby Radio Shack store, dealer, or Computer Center. For complete information on Radio Shack's extensive line of educational courseware, return the coupon below.

Radio Shack Education Division
Dept. 82-A-325
1300 One Tandy Center
Ft. Worth, Texas 76102

NAME ______
SCHOOL ______
ADDRESS ______
CITY ______ STATE ______
ZIP ______ PHONE ______

Radio Shack®

The biggest name in little computers™

A DIVISION OF TANDY CORPORATION

Retail prices may vary at individual stores and dealers.

Planning Your School's Future Growth?

OMNINET™ Can Help You Today.

Omninet is the first low-cost high-performance local network specifically designed to meet the special needs of educators. It provides today what other networks only promise for tomorrow.

Multiple micros, from two to 64, can be linked together over thousands of feet with OMNINET. All computers can share expensive peripherals, such as printers, and have access to a large data base on Corvus Winchester disk systems.

Networking with OMNINET permits both classroom and administrative use of the multi-megabyte mass storage, plus computer conferencing and electronic mail.

Intelligence for OMNINET is located in a Transporter interface in each computer. If one computer goes down, all others remain active.

Networking with OMNINET is easy. It's as simple as hooking up stereo speakers. OMNINET is made up of a twisted pair of wires and a plug-in Transporter for each peripheral.

Estimate your school's computer growth. With OMNINET, computers can be added or removed from the line without any disruption of service. Highly reliable software, field proven in over 1,000 installations, is already available.

Today Corvus offers you an intelligent solution to tomorrow's communication needs, just as we have been supplying an intelligent solution to mass storage with our 5, 10, and 20, megabyte Winchester disks for the past two years.

Contact Corvus today for full details.

CORVUS SYSTEMS
2029 O'Toole Avenue
San Jose, Calif. 95131
408/946-7700 TWX: 910-338-0226